



Galaxy® HDX4

ISO 9001:2008
ISO 13485:2003 Certified

*Installation and Hardware
Reference Manual*

MODELS:

» GX4L_2120S4_12I1

12 BAY iSCSI Quad 1Gb to
SAS/SATA II RAID Subsystem
Single Controller

Galaxy HDX4 12 Bay RAID

iSCSI Host SAS / SATA Drives

7th Generation Fibre Channel RAID

With over 10,000 Galaxy units in the field, Rorke Data's award winning RAID products provide the performance, protection, and expansion capabilities for diverse customer environments.

PLEASE READ BEFORE INSTALLATION

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Warnings and Certifications



RESTRICTED ACCESS LOCATION:

This equipment is intended to be installed in a RESTRICTED ACCESS LOCATION only.

- Access can only be gained by SERVICE PERSONS or by USERS who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and
 - Access is by an authorized person through the use of a TOOL or lock and key, or other means of security, and is controlled by the authority responsible for the location.
-



ELECTRIC SHOCK WARNING!

To Prevent Electric Shock:

1. Access to this equipment is granted only to trained operators and service personnel who have been instructed of and fully understand the possible hazardous conditions and the consequences of accessing non-field-serviceable units, e.g., system backplane or power supplies.
 2. Unplug the system before you move it or when it has become damaged.
-



RELIABLE EARTHING!

Particular attention should be given to prepare reliable earthing with the power supply connections other than direct connections to the branch circuit (e.g., use of power strips). The AC power cords provide the main earth connection. Check proper grounding before powering on the enclosure.



OVERLOADING PROTECTION!

1. The enclosure should be installed according to specifications on a chassis label. Provide a suitable power source with electrical overload protection.
 2. Do not overload the AC supply branch circuit that provides power to the rack. The total rack load should not exceed 80 percent of the branch circuit rating.
-



BATTERY USE WARNING!

Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to local ordinance.



THERMAL PRECAUTIONS:

1. If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Appropriate measures, such as increasing airflow, should be available to maintain the temperature below 35°C.
 2. The openings on the enclosure are for air convection. DO NOT COVER THE OPENINGS.
 3. To comply with safety, emission, and thermal requirements, all module bays should be populated with plug-in modules. The system should not be operated with the absence of any covers.
-



HANDLING PRECAUTIONS:

1. The system can either be installed into a standard EIA-310 19" rack cabinet or placed on a desktop. Mechanical loading of the enclosure should be carefully handled to avoid hazardous condition. A drop or fall could cause injury.
 2. Lay this system on a reliable surface with desktop installation. A drop or fall can cause injury.
 3. Mounting this enclosure requires two people.
 4. The enclosure can weigh up to 37Lbs (17kg) without disk drives. With disk drives loaded, the enclosure can weigh up to 60lb (24kg). A reliable surface should be available to support this weight.
 5. Disk drives should be installed after the enclosure is securely installed.
-

FCC (applies in the U.S. and Canada)

FCC Class A Radio Frequency Interference Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device may accept any interference received, including interference that may cause undesired operation.

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARNING:

A shielded power cord is required in order to meet FCC emission limits and also to prevent interference to nearby radio and television reception.

Use only shielded cables to connect I/O devices to this equipment. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.



This device is in conformity with the EMC.



(Certified Worldwide)

This device meets the requirements of the CB standard for electrical equipment with regard to establishing a satisfactory level of safety for persons using the device and for the area surrounding the apparatus. This standard covers only safety aspects of the above apparatus; it does not cover other matters, such as style or performance.



For Power Supplies' compatibility to China Compulsory Certification.

China RoHS

In Compliance with AeA China RoHS Regulations (SJ/T 11364-2006)

有毒有害物质或元素的名称及含量

部件名称	有毒有害物质或元素					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(Cr6+)	多溴联苯(PBB)	多溴二苯醚(PBDE)
PCBA	X	O	O	O	O	O
机壳机架	X	O	O	O	O	O

O:表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006规定的限量要求以下。
X:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006规定的限量要求。

说明：

于PCBA部分：

1. 主动(半导体)组件：高熔点焊料合金中含有铅
2. 被动组件：电子陶瓷组件含有铅
3. 组件脚(脚距小于0.65mm之主、被动组件及连接器)含有铅
4. LCD模块所使用的光学玻璃含有铅

于机壳机架部分：

机壳机架中的钢合金、铝合金及铜合金含有铅

* 上述项目皆碍于技术上不够成熟、经济上及可靠度上不可行而含有过量有毒物质



ITE BSMI Class A, CNS 13438 (for Taiwan)

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。



This device is in conformity with UL standards for safety.



Инструкция по безопасности

Модель:

FC to SAS/SATA 3U/16, 4U/24 Bay RAID Subsystem, Models, where "x" can be "0-9", "A-Z", blank, or dash "x" for marketing purpose and no impact safety related critical components and constructions.

1. Перед использованием оборудования внимательно прочтите инструкцию.
2. Сохраняйте инструкцию для дальнейшего использования в работе.
3. Не допускайте попадания влаги на изделие.
4. Устанавливайте оборудование на устойчивую поверхность. Падение может нанести ущерб оборудованию.
5. Соблюдайте климатические требования, использование оборудования при температуре окружающей среды выше 50°C, может привести к выходу оборудования из строя.
6. Размещайте шнур питания в недоступном для пользователя месте. Запрещается ставить на шнур питания какие-либо предметы.
7. При работе с оборудованием необходимо учитывать все предупреждения и замечания.
8. Если оборудование не используется в течении длительного времени, отключите его от сети питания.
9. Запрещается вскрывать оборудование. Оборудование может

- вскрывать только квалифицированным персоналом.
10. При возникновении одного из повреждений оборудования вызовите обслуживающий персонал:
 - а. Повреждение шнура питания или вилки.
 - б. Оборудование не работает или его работа не соответствует инструкции пользователя.
 - в. Оборудование повреждено.
 - г. Оборудование имеет очевидный признак поломки.
 11. Источник питания должен быть установлен в соответствии с инструкцией. Ток нагрузки и выходная мощность не должны превышать указанных в спецификации.



Rorke is committed to being properly prepared and taking all the necessary steps that will result in our compliance with the new European directive, RoHS (2002/95/EC), on or before the specific dates set forth in those applicable laws and regulations. Rorke is applying its own internal efforts and expertise and is working closely with customers and suppliers to achieve compliance while maintaining an uninterrupted supply of quality products. Rorke is currently investigating, evaluating, and qualifying our materials and components to ensure that products sold on or after 1 July 2006, in such territory, are in compliance with the above regulations.



Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By proper waste handling of this product you ensure that it has no negative consequences for the environment and human health, which could otherwise be caused if this product is thrown into the garbage bin. The recycling of materials will help to conserve natural resources.

For more details about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

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Safety Precautions

Precautions and Instructions

- Prior to powering on the subsystem, ensure that the correct power range is being used.
- If it is necessary to transport the subsystem, repackage all disk drives separately in the drive trays and in the original package foam blocks. If using the original package material, other replaceable modules can stay within the enclosure.
- The Galaxy subsystems come with 12, 16, or 24 drive bays. Leaving any of these drive bays empty will greatly affect the efficiency of the airflow within the enclosure, and will consequently lead to the system overheating, which can cause irreparable damage.
- If a module fails, leave it in place until you have a replacement unit and you are ready to replace it.

- **Airflow Consideration:** The subsystem requires an airflow clearance, especially at the front and rear. A clearance of at least 18 to 20 centimeters is required at the rear side and any objects blocking the exhaust airflow, e.g., cables dangling at the fan outlet, should be avoided.
- Handle subsystem modules using the retention screws, eject levers, and the metal frames/face plates. Avoid touching PCB boards and connector pins.
- To comply with safety, emission, or thermal requirements, none of the covers or replaceable modules should be removed. Make sure that all enclosure modules and covers are securely in place during operation.
- Be sure that the rack cabinet into which the subsystem chassis will be installed provides sufficient ventilation channels and airflow circulation around the subsystem.
- Provide a soft, clean surface to place your subsystem on before working on it. Servicing on a rough surface may damage the exterior of the chassis.
- If it is necessary to transport the subsystem, repackage all drives separately.
- Dual-redundant controller models come with two RAID controllers that should always be present. Single-controller models come with a single RAID controller and a metal sheet is placed over the lower controller bay at the rear of the subsystem. Since single-controller models cannot be upgraded, this metal sheet should NEVER be removed.

ESD Precautions

Observe all conventional anti-ESD methods while handling system modules. The use of a grounded wrist strap and an anti-static work pad are recommended. Avoid dust and debris in your work area.

About This Manual

This manual:

- Introduces the Galaxy storage system series.
- Describes all major components in the system.
- Provides recommendations and details about the hardware installation process.

- Describes how to monitor system operating statuses.
- Describes how to maintain the subsystem.

This manual does not:

- Describe components that are not user-serviceable.
- Give a detailed description of the RAID processing units or the RAID controllers within the subsystem.

Revision History

Rev. 1.0: Initial release.

Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Related Documentation

- Generic Operation Manual (firmware operation via LCD keypad and terminal emulation)

These documents are included in the product utility CD that came with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the Galaxy series is referred to as simply the “subsystem” or the “system” and Rorke is sometimes abbreviated as “Gal.”



Important Messages

Important messages appear where mishandling of components is possible or when work order can be mis-conceived. These messages also provide important information associated with other aspects of system operation. The word “important” is written as “**IMPORTANT**,” both capitalized and bold and is followed by text in italics. The italicized text is the message to be delivered.



Warnings

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously. Warnings are easy to recognize. The word “warning” is written as “**WARNING**,” both capitalized and bold and is followed by text in italics. The italicized text is the warning message.



Cautions

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system. Cautions are easy to recognize. The word “caution” is written as “**CAUTION**,” both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.



Notes

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes. Notes are easy to recognize. The word “note” is written as “**NOTE**,” both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot “•.”

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Software and Firmware Updates

Please contact your system vendor or contact Rorke’s technical support techsupport@rorke.com for the latest software or firmware updates. **NOTE** that the firmware version installed on your system should provide the complete functionality listed in the specification sheet/user’s manual. We provide special revisions for various application purposes. Therefore, **DO NOT** upgrade your firmware unless you fully understand what a firmware revision will do.

Problems that occur during the updating process may cause irrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.

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Chapter 1

Introduction

1.1 Product Overview

1.1.1 Introduction

This chapter briefly introduces the Galaxy® HDX4 iSCSI to SAS / SATA RAID subsystem. The HDX4 DS system comes with four (4) Gigabit Ethernet host ports on the RAID controller and delivers fast I/O performance over iSCSI packets.



Galaxy HDX4 12bay RAID System

Galaxy's iSCSI storage supports network initiators compatible with the IETF (Internet Storage Name Server) iSCSI standard (RFC 3720) with the following functionality:

- Access control via NetMask, IQN, and IP filtering
- iSNS & SLP device discovery
- CHAP access control security
- Jumbo frames

Internet SCSI (iSCSI) protocols are embedded in firmware and I/Os and are rapidly processed via dedicated algorithms. The HDX4 DS is built around reliable hardware and sophisticated RAID technologies. I/O requests are packaged and transmitted over local area networks (LANs), wide area networks (WANs), or the Internet using the existing Ethernet network, and thus the total cost of ownership is reduced. With the help of networking flexibility, the system is ideal for location-independent data storage, backup, and retrieval.

The system delivers extreme performance that results from the combined performance of multiple disk drives and the level of data protection unseen in other iSCSI storages. Featuring all standard RAID functionality, the HDX4 DS subsystem provides a reliable platform for IT operations such as backup, data-mining, or strategic data allocation.

This system features a high-density architecture that supports up to twelve (12) hot-swappable 6Gb/s SAS or 3Gb/s SATA hard drives. The system is powered by a single RAID controller featuring the latest ASIC667 as the RAID engine. The pre-installed 2GB DDRII RAM DIMM module can be upgraded to a 4GB capacity DIMM to support complicated applications that hold numerous I D/LUN combinations.

In addition to the ease of implementation, the HDX4 DS also supports capacity expansion via its SAS links by attaching HDX4 DS 12 or 16 bay JBODs.

The modular nature of the system and the easy accessibility to components ensure ease of maintenance.



NOTE:

On receiving and unpacking your subsystem, please check the package contents against the included **Unpacking List**. If any modules are missing, please contact your system vendor immediately.

1.1.2 Enclosure Chassis

1.1.2.1 Chassis Overview

The HDX4 DS system is housed in a robust 2U chassis that is divided into front and the rear sections. Key components are respectively accessed through the front and rear panels. The enclosure chassis can be mounted into a standard 19-inch rack or enclosure cabinet using support brackets that are separately purchased.



NOTE:

Components accessed through the front panel are referred to as “**Front Panel Components**” and components accessed through the rear panel are referred to as “**Rear Panel Components**.”

1.1.2.2 Physical Dimensions

The HDX4 DS comes in a 2U chassis with the following dimensions:

- Measured with forearm handles: 481mm x 89mm x 530mm (width x height x depth)

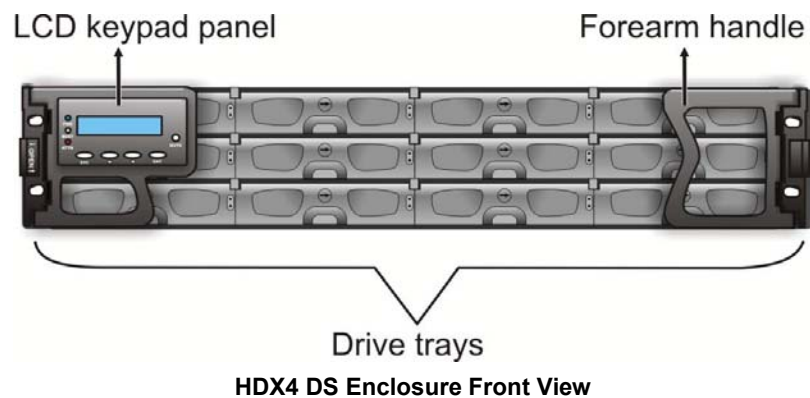
- Measured without forearm handles: 446mm x 88mm x 513mm (width x height x depth)

1.1.2.3 Front Panel Overview

The front section of the system features a 4x3 layout for twelve (12) 3.5-inch disk drives. The two (2) handles on the front of the system enable you to easily extract the chassis from a rack or cabinet. The front view is shown below. A description of each front panel component is given below:



The front view of the subsystem without the bezel installed is shown below:



The front panel components include:

- **Drive bays with drive tray canisters:** The drive bays accommodate 6Gb/s SAS or 3Gb/s SATA 3.5" disk drives.
- **Forearm handles:** The system has right- and left-side handles for easier rackmount handling.

1.1.2.4 Hard Drive Numbering

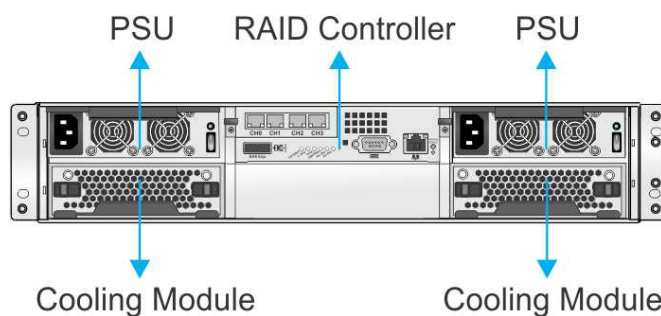
The front section of the HDX4 DS enclosure houses twelve (12) hard drives in a 4x3 configuration. When viewed from the front, the drive bays (slots) are numbered 1 to 12 from left to right and then from top to bottom.

Slot 1	Slot 2	Slot 3	Slot 4
Slot 5	Slot 6	Slot 7	Slot 8
Slot 9	Slot 10	Slot 11	Slot 12

Hard Drive Numbering

1.1.2.5 Rear Panel Overview

The enclosure rear view is shown below. The rear panel provides access to all enclosure components. A description of each rear panel component is given below:



HDX4 DS Enclosure Rear View

The enclosure rear section accommodates the following components:

- **RAID controller module:** The RAID controller module manages all functionalities provided with the system, and all interface connectors are provided on the controller faceplate.
- **CBM module (optional feature; located within the RAID controller module, if installed):** A CBM (Cache Backup Module) is optional for the single-controller HDX4 DS. The CBM consists of a BBU (Battery Backup Unit) and FBM (Flash Backup Module). The BBU sustains unfinished writes cached in memory and cached data is distributed to the FBM in the event of a power outage in order to prevent data loss.
- **PSU modules:** The hot-swappable PSUs supply power to the subsystem. Power on/off is controlled by the individual power switches on the power supplies.
- **Cooling modules:** The redundant cooling modules ventilate the system to maintain a cooling airflow across the system.

1.1.2.6 Backplane Board

An internal backplane board separates the front and rear sections of the enclosure. The backplane consists of traces for logic level signals and low voltage power paths. It contains no user-serviceable components.

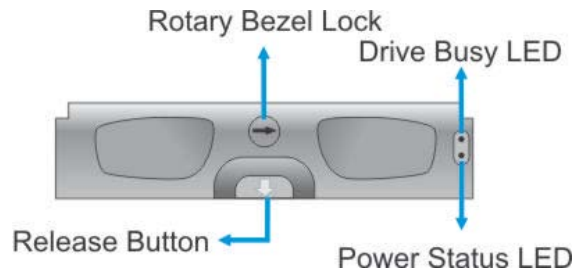
**WARNING!**

When inserting a removable module, **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the pins on the module connectors either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more pressure to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.

1.2 System Components

The HDX4 DS houses many active components and most of them can be accessed through either the front or the rear panel. The modular design of the components facilitates their easy installation and removal. Hot-swap mechanisms are incorporated to eliminate power surges and signal glitches that might occur while removing or installing these modules.

1.2.1 Drive Trays



Drive Tray Front View

The system comes with twelve (12) drive trays with 1-inch pitch, 3.5-inch 6Gb/s SAS or 3Gb/s SATA disk drives pre-installed. The drive bays are accessible from the enclosure front panel. Two (2) LEDs on the front bezel indicate the operating statuses. A rotary bezel lock on each drive tray secures the hard drive in place, while a release button enables fast retrieval of a hard drive. There are screw holes on the sides of the drive tray for securing hard drives to the drive tray.

**WARNING!**

Be careful not to warp, twist, or contort the drive tray in any way (e.g., by dropping it or resting heavy objects on it). The drive tray has been customized to fit into the drive bays of the system. If the drive bay superstructure is deformed or altered, the drive trays may not fit into the drive bays.

1.2.2 The RAID Controller Module

The default size for the DDRII DIMM module on the RAID controller is 2 GB. A RAID controller module contains a main circuit board, a pre-installed memory, battery charger circuitry, and a daughter board with host port interfaces. The controller module contains no user-serviceable components. Except when servicing the cache memory or the CBM module inside, the controller module should never be removed or opened.



WARNING!

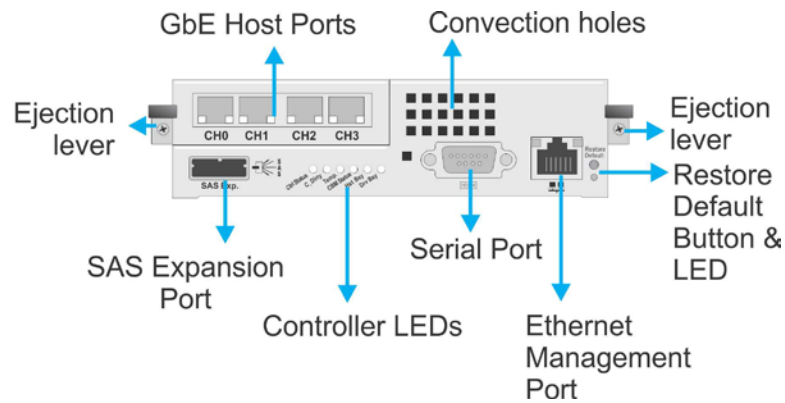
Although the RAID controller can be removed, the only time you should touch the controller itself is to install or replace the memory module and CBM. The RAID controller is built of sensitive components and unnecessary tampering can damage the controller.

The HDX4 DS system is managed by the RAID controller. The controller comes with four (4) GbE Ethernet host ports. The system connects to the host through RJ-45 connectors, while the connectors are also ready to connect to one or more network switches, enabling access to your storage volumes in complex configurations such as data-sharing or Virtual LAN segments.

The docking connector at the rear of the controller board connects the controller module to the backplane board.

1.2.3 Controller Module Interfaces

The controller interfaces are accessed through the controller faceplate as shown in the figure below.



Controller Faceplate

- **Host ports:** Four (4) Gigabit Ethernet host ports (indicated as CH0, CH1, CH2 and CH3 in the diagram shown above) connect the HDX4 DS system to the networked iSCSI initiators through RJ-45 connectors.
- **SAS Expansion:** The **SAS Expansion** port is meant to connect to expansion enclosures, i.e., Galaxy's HDX4 DS JBOD enclosures. The system can connect to a maximum of **six (6)** expansion enclosures. For the expansion connection, you need SFF-8088 to SFF-8088 SAS cables. As for the connection between expansion enclosures, you also need SFF-8088 to SFF-8088 SAS cables.
- **Serial Port:** The controller module comes with one (1) COM port. The serial port is used for local access to the firmware-embedded, menu-driven configuration utility using a terminal emulation program.
- **Ejection Levers:** Two (2) ejection levers on the sides of the controller ensure that the back-end connectors are properly seated in the module slot and properly mated with the backplane.
- **Ethernet Management Port:** A 10/100BaseT Ethernet management port connects the system to a network and then to a management computer. Available management interfaces include telnet and Java-based Galaxy Array Manager.
- **Controller LEDs:** Each controller board rear panel comes with six (6) controller status LED indicators. Please refer to **Chapter 4** for information on how to monitor your subsystem using these LED indicators.
- **Restore Default Button & LED:** The restore default button and LED are used to restore firmware defaults when upgrading firmware, upgrading DIMM size, or if an

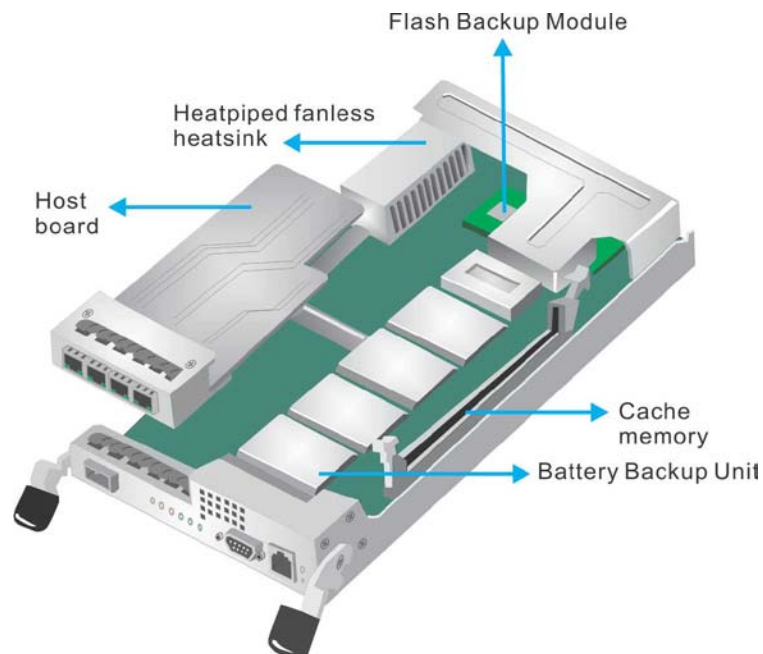
administrator forgets the system password. For more details, please refer to **Chapter 4**.

1.2.4 Cache Module

The controller default for the cache module is a 1GB DDRII module and the maximum size that can be allocated is 4GB. The memory socket is located on the side of the controller board.

1.2.5 CBM (Optional Feature)

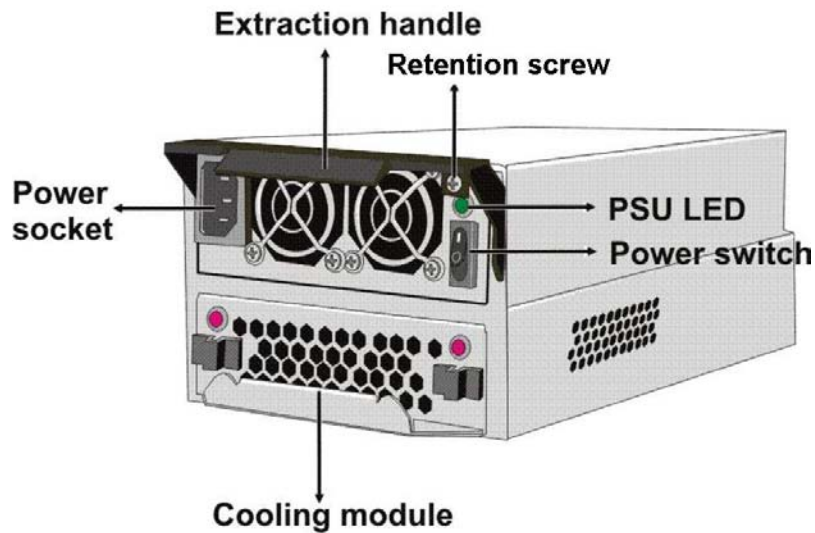
The Cache Backup Module (CBM) is an optional feature for the HDX4 DS. The CBM consists of a Li-Ion battery backup unit (BBU) module and a flash backup module (see the diagram below). The BBU can support the transfer of cached data from cache memory to an onboard flash backup module in the event of a power outage.



Modules within a Controller Canister

The BBU is only partially charged when shipped. Therefore, after powering on the subsystem the BBU will start charging to its full capacity. It normally requires approximately twelve hours for the battery to be fully charged. If the battery is not fully charged after twelve hours, there may be a problem with the BBU and you should contact your subsystem vendor immediately. You can also check the status of the battery module via Galaxy Array Manager, or the firmware.

1.2.6 Power Supply Units



PSU Canister

The subsystem is equipped with two (2) redundant, hot-swappable, 350W PSUs, which are located at the enclosure's rear section. The PSU is permanently mounted into a 2U canister especially designed to contain both the PSU and a cooling module. If the PSU is removed, the cooling module is also removed.

As shown in the figure above, each PSU comes with a power socket for power cord connection and an on/off power switch. A single LED indicates the PSU status. When a PSU failure occurs, the LED is lit constantly red. A handle above the PSU enables you to safely retrieve or install the PSU into the chassis.

A retention screw helps secure the PSU within the module bay. To remove the PSU, the retention screw must be removed first. After you install a PSU, make sure the retention screw is firmly secured.

For detailed specifications of the power supply, please refer to **Appendix A**.

1.2.7 Cooling Modules



Cooling Modules

Two (2) cooling modules are implemented. The blowers within operate at different fan speeds. When the system operates normally, the cooling fans operate at the lower speed. If a major component fails or when one of the temperature thresholds is violated, the blowers automatically raise its rotation speed.

1.3 System Monitoring

The subsystem comes with a number of different monitoring methods that provide you with continual updates on the operating statuses of the subsystem and individual components. The following monitoring features are included:

1.3.1 I2C bus

The following system elements are interfaced to the RAID controller over a non-user-serviceable I²C bus:

- Power supplies and cooling modules
- Module presence detection circuits
- Temperature sensors (for detecting the temperature on the backplane board and controller board)

1.3.2 LED Indicators

The following active components come with LEDs to indicate the status of individual components. Please refer to **Chapter 4** for more information on system monitoring.

- LCD keypad panel: three (3) status LEDs
- Drive trays: two (2) LEDs on each tray
- RAID controller:
 - six (6) system status-indicating LEDs
 - two (2) Ethernet management port status LEDs
 - two (2) LEDs per host port
 - one (1) LED specifically for the Restore Default functionality
- Expansion link status is indicated by LEDs on the expansion enclosures.
- Cooling modules: two (2) LED on each cooling module
- PSUs: one (1) LED on each module

1.3.3 Audible Alarms

The system comes with an audible alarm that is triggered when a component fails or when the pre-configured temperature or voltage thresholds are exceeded. Whenever you hear an audible alarm, it is imperative that you determine the cause and rectify the problem immediately.

Event notification messages indicate the completion configuration tasks, status of components, or fatal errors. Events are always accompanied by two (2) or three (3) successive and prolonged beeps.



WARNING!

When an audible alarm is heard, system administrators should rectify the cause of the alarm as soon as possible.

1.4 Hot-swappable Components

1.4.1 Hot-swap Capabilities

The system comes with a number of hot-swappable components. A hot-swap component is one that can be exchanged while the system is still operating. These components should only be removed from the chassis when they are being replaced. At no other time should these components be removed from the system.

1.4.2 Components

The following components are hot-swappable:

- Power supply units (PSUs)
- Cooling modules
- Hard disk drives

1.4.3 Normalized Airflow

Proper cooling is referred to as “normalized” airflow. Normalized airflow ensures the sufficient cooling within the system and is only attained when all components are properly installed. Therefore, a failed component should only be removed when a replacement is available. If a failed component is removed but not replaced, airflow will be disrupted and damage to the system can result.

Chapter 2

Hardware Installation

2.1 Introduction

This chapter provides detailed instructions on how to install the system. Installation into a rack or cabinet should occur **before** the hard drives or drive trays are installed into the system. Please confirm that you received all of the components listed on the included **Unpacking List** before proceeding with the installation process.



CAUTION!

Carefully follow the installation instructions described in this manual to prevent difficulties during installation and damage to your subsystem.

2.2 Installation Prerequisites

1. **Static-free installation environment:** The Galaxy HDX4 system must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage.
2. **Component check:** Before installing the Galaxy HDX4 system, you should first check whether you have received all the required components. If any items appear damaged, contact your vendor for a replacement.
3. **Hard drives:** Up to twelve (12) SAS 6Gb/s or SATA 3Gb/s hard drives have been preinstalled based on your requested requirements.



NOTE:

Regarding SATA disk drives, currently only 3Gb/s SATA disk drives are supported. Make sure you properly configure HDD configuration (such as jumper setting) before you install hard drives into the system. Some hard drives come with a default speed set to 1.5Gb/s.

If using SATA hard disks that are defaulted to 1.5Gb/s, compatibility issues may occur.

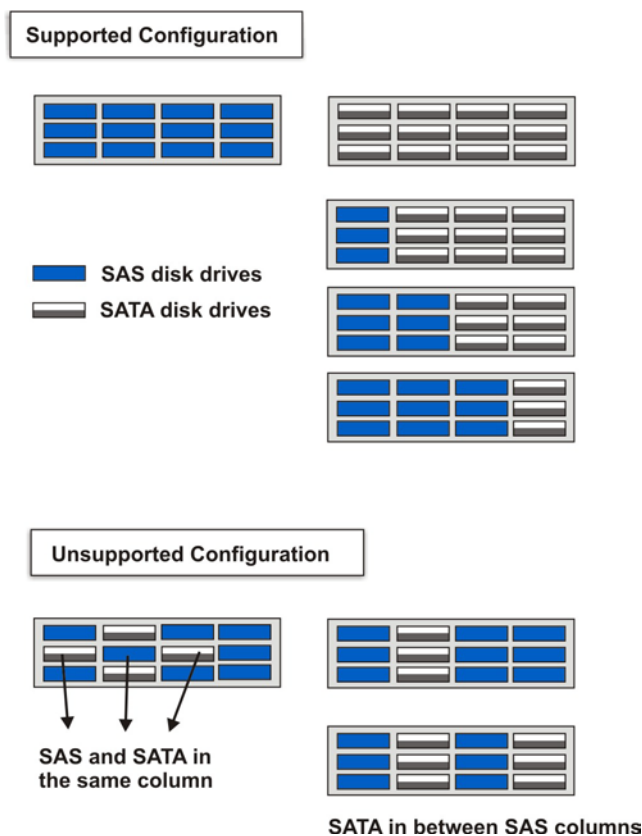
4. Cabling:

The Galaxy HDX4 model comes with the following cables:

1. Two (2) power cords for connections to the power sources. Cable type is determined by the shipped-to area.

Other cables are user-supplied:

1. Serial cable for connecting a terminal station.
2. Ethernet cables to the Ethernet management port.
3. Host link cables.
5. Mixing SAS and SATA drives in the same enclosure is allowed. However, please **DO NOT** mix SAS and SATA drives in the same drive column.
6. **DO NOT** place a column of SATA disk drives between two columns of SAS disk drives. With a higher rotation speed, SAS disk drives on the flanks of SATA disk drives will eventually cause a stability issue.



Supported and Unsupported Mixed Drive Configurations

7. **Memory modules:** If you wish to change the pre-installed 2GB DDRII DIMM module, DIMM replacement procedures can be found in **Chapter 5**.
8. **CBM:** If you wish to install the optional CBM, do it before you power on the system. Please refer to CBM installation procedures at the end of this chapter.
9. **Rack installation:** The enclosure chassis can be installed into a rack cabinet using separately purchased rackmount brackets, or Infortrend's **IFT-9373CSLIDER36** brackets.

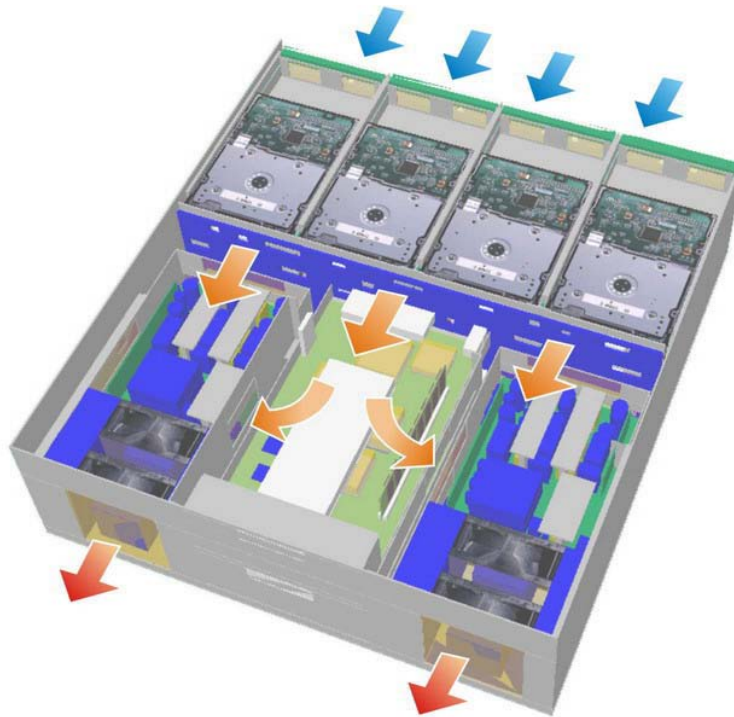
2.3 Safety Precautions

2.3.1 Precautions and Instructions

1. **Static-free installation environment:** The enclosure must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage.
2. **Component check:** Before installing the enclosure, check to see that you have received all the required components. If any items appear damaged, contact your vendor for a replacement.

3. **Rack installation:** The enclosure chassis can be installed into a rack cabinet using separately purchased mounting rails, support brackets, or Infortrend's **IFT-9373CSLIDER36** rackmount rails.
4. Disconnect the power cords if the need should arise for cleaning the chassis. Do not use liquid or sprayed detergent for cleaning. Use a lightly moistened cloth for cleaning.
5. Be sure the correct power range (100-120 to 220-240VAC) is supplied by the power source at your installation site. It is highly recommended to connect two different power supplies to separate power sources; e. g., one to a power outlet, and the other to a UPS system.
6. Thermal notice: All drive trays (even if they do not contain a hard drive) must be installed into the enclosure. Leaving a drive bay or module slot open will severely affect the airflow efficiency within the enclosure, and will consequently lead to system overheating. Keep a faulty module in place until you have a replacement unit and you are ready to replace it.
7. Rack-mounting: The system is intended to be rack-mounted. The following concerns should be heeded when mounting the enclosure into a rack cabinet:
 - a. An enclosure without disk drives can weigh 17 kilograms. Two (2) people are required to install or relocate the system. Drives should be removed from the enclosure before moving the system.
 - b. The system is designed to operate in an environment where the ambient temperature around the chassis must not exceed 35°C.
 - c. The openings on the enclosure are for air circulation and hence the ventilation openings should never be obstructed.
 - d. Proper grounding, over-current protection, and stability features should be provided with the rack cabinet into which the system is mounted.
8. Operate the system in an environment with least humidity.
9. Place the system on a reliable surface when servicing individual modules. A drop or fall can cause injury.
10. Make sure the voltage of the power source is within the rated values before connecting the system to the power source. You may also refer to **Appendix A** of this manual for technical details.
11. Airflow considerations: The system requires an airflow clearance especially on the front and the rear sides. For proper ventilation,

a minimum of 2.5cm is required between the front of the enclosure and rack cover; a minimum of **18 to 20cm** is required on the rear side.



Airflow Direction

12. Do not cover the convection holes on the controller faceplate. They provide passages for air circulation, and also a glimpse of the 7-seg LED for debug purposes.
13. Handle the system modules by the retention screws, ejection levers, or the modules' metal frames/faceplates only. Avoid touching PCB boards and connector pins.
14. None of the covers or replaceable modules should be removed, so as to maintain compliance with safety, emission, or thermal requirements.
15. If the system is going to be left unused for a long time, disconnect the system from mains to avoid damages by transient over-voltage.
16. Never pour any liquid into ventilation openings; this could cause fire or electrical shock.
17. Never open the system top cover. For safety reasons, only qualified service personnel should access the interior of the chassis.

18. Always secure every enclosure module by its retaining screws or make sure it is held in place by its latches or hand screws.
19. Always make sure the system has a safe electrical earth connection via power cords to the power source sockets at the installation site.
20. Be sure that the rack cabinet in which the system chassis is to be installed provides sufficient ventilation channels and airflow circulation around the chassis.
21. Provide a soft, clean surface to place your enclosure on before working on it. Servicing the enclosure on a rough surface may damage the finish of the chassis.
22. If it is necessary to transport the system, repackage all disk drives separately.
23. If one of the following situations arises, get the enclosure checked by service personnel:
 - a. Any of the power cords or plugs is damaged.
 - b. Liquid has penetrated into the system.
 - c. The enclosure has been exposed to moisture.
 - d. The system does not work well or you cannot get it to work according to this manual.
 - e. The system has dropped and been damaged.
 - f. The system shows obvious signs of breakage.

2.3.2 Static-free Installation

Static electricity can damage the system's electronic components. To prevent ESD damage to any of the components, follow these precautions before touching or handling them:

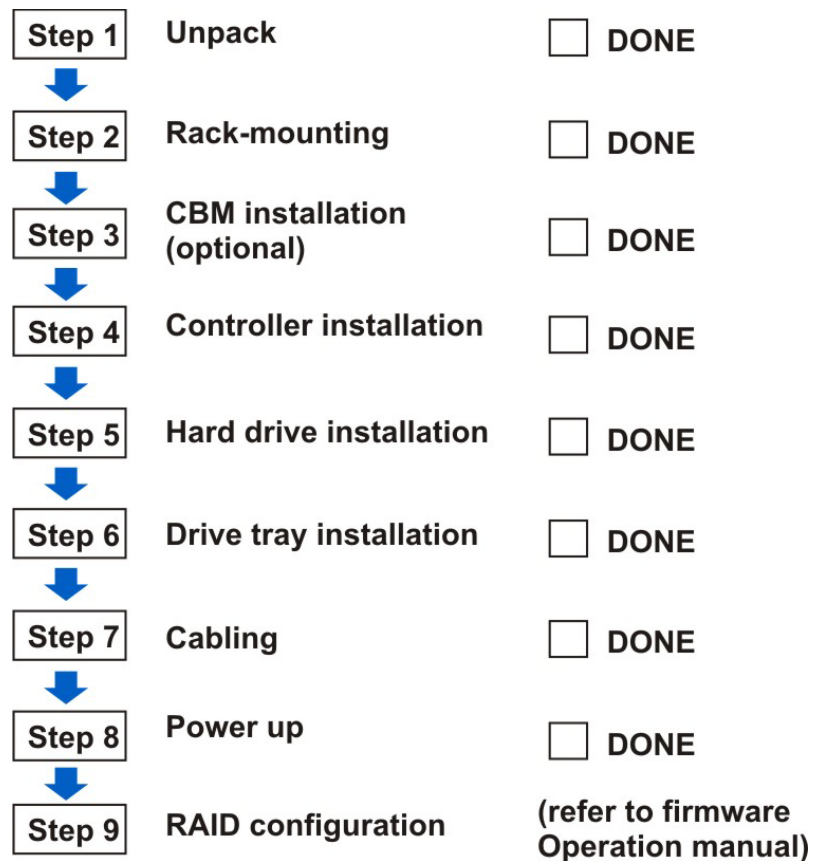
- Discharge the static electricity accumulated in your body by wearing an anti-static wristband.
- Use antistatic strap during handling. Connect the equipment end of the strap to an unfinished chassis surface.
- Avoid carpets, plastic, vinyl, and styrofoam in your work area.
- If the need should arise for carrying system modules from one place to another, carry them in a static shielding container.
- Avoid contact between circuit boards and clothing.

Handle all components by holding their edges or metal frames. Avoid touching the exposed circuitry on PCB boards and connector pins.

2.4 General Installation Procedure

2.4.1 Installation Procedure Flowchart

A flowchart of the installation procedure is shown below. As you complete each step, check off the “**Done**” box on the right. Please use this flowchart in conjunction with the instructions that follow.



Installation Flowchart

2.5 Unpacking the System

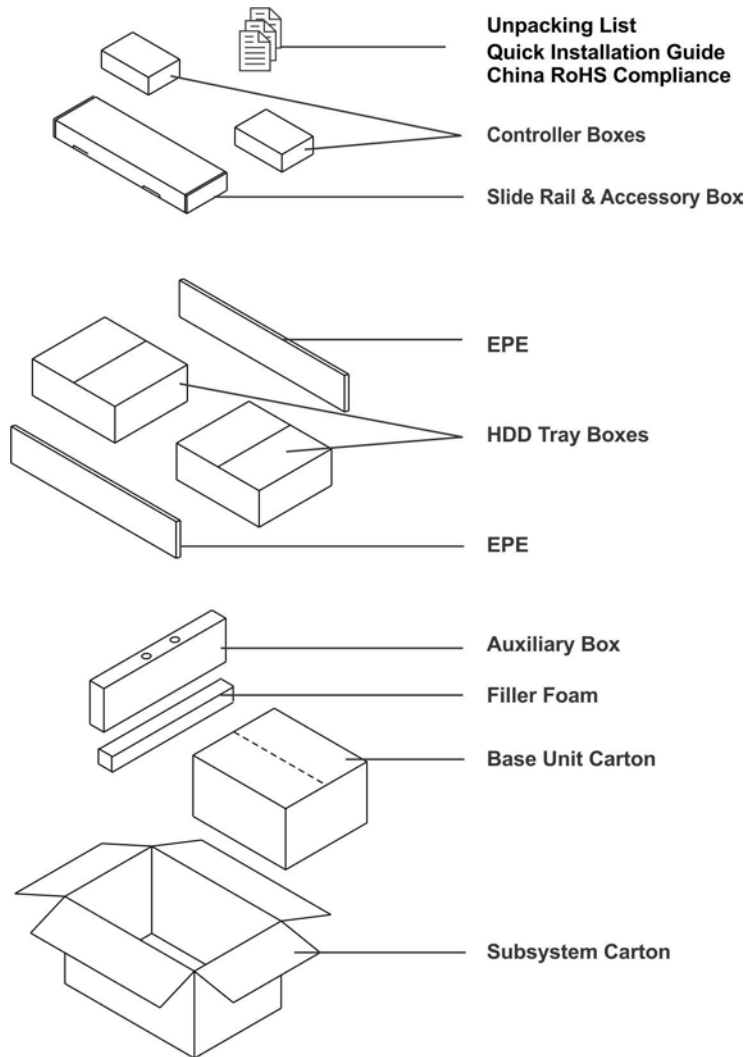
Compare the **Unpacking List** against the actual package contents to confirm that all required materials have been received. Carefully check the items contained in each box before proceeding with installation.



WARNING!

A detailed unpacking list can be found in your product shipping package or product CD.

The package contents are shown below:



The package contents include:

1. Two power cords.
2. Screws for rack-mounting and securing disk drives.
3. A printed copy of the **Quick Installation Guide**.
4. A product utility CD containing the **Installation and Hardware Reference Manual** (this document), the **Operation Manual** (firmware), the Galaxy Array Manager and **Galaxy Array Manager User's Manual**, and other related documentation.
5. If ordered, rackmount rails will be included.

6. If additional power cords or host links cables have been included in a placed order, they will be shipped in the auxiliary box.

Preinstalled Components

The following components have been installed at the factory and do not need to be installed:

- 1 - Backplane board
- 1 - DDRII DIMM module
- 2 - PSU modules
- 1 - LCD keypad panel
- 2 - Cooling fan modules

Components to be Installed

You must install the following components:

- Rackmount rails (if purchased)
- Cache backup module (optional)
- RAID controller
- Hard drives / Drive trays
- Cables

2.6 Rack/Cabinet Installation

The system is designed to fit into a variety of 19-inch rack cabinets or racks. Make sure you have an appropriate site location and cables prepared with adequate lengths to connect to power source and other devices.

When installing the system into a rack or cabinet it is advisable that two (2) people assist in the mounting process.

Package Contents

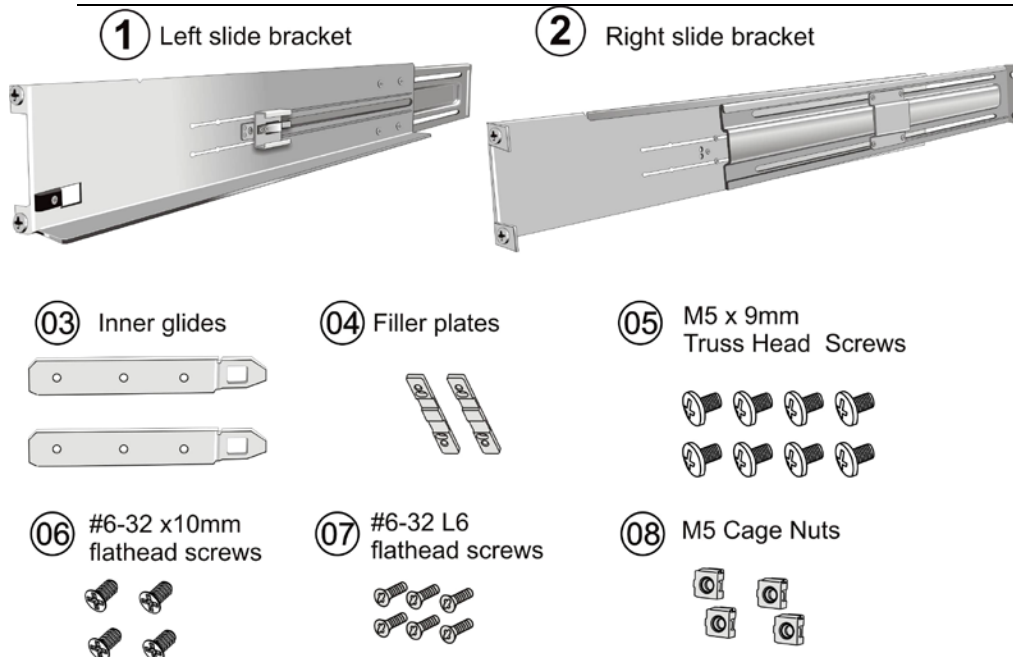
The rackmount rail kit should include the following components:

Item	Description	Quantity
01	Mounting bracket assembly, L-shape, left-side	1
02	Mounting bracket assembly, L-shape, right-side	1
03	Inner glide	2
04	Flange filler plate (fixed behind chassis ears)	2
05	Cross recess truss head screws M5 x 9.0mm	8
06	#6-32 x10mm flathead screws	4
07	#6-32 L6 flathead screws	6
08	M5 cage nuts	4



NOTE:

Screws for securing chassis to the front rack posts are provided in the system's **accessory box**. There are 4 M5 x35mm, 4 M6 x35mm, and 4 #10-32 31.75mm screws.



Rackmount Rail Components

Installation Pre-requisites

- One (1) medium-size and one (1) small-size cross-head screwdrivers
- One (1) medium-size flat-head screwdriver
- Because the RAID system can weigh 17 kilograms without hard disk drives, two (2) people are required to rack-mount the enclosure.



CAUTION!

The hard drives and drive trays should only be installed into the system after the system has been mounted into a rack cabinet. If the hard drives are installed first, the system will be too heavy to handle and the possible impact during installation may damage your drives.

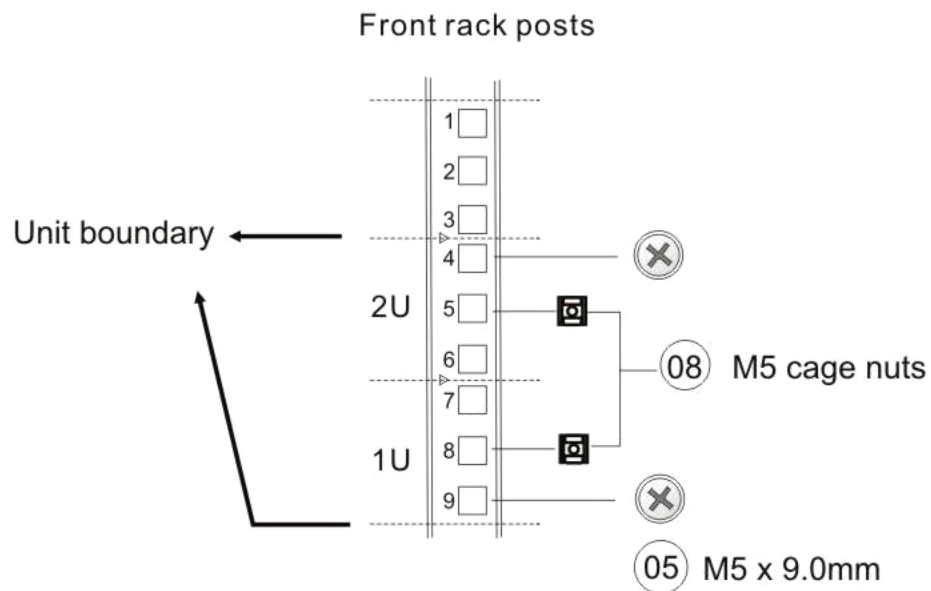
Rack-mounting Steps

- Step 1.** Determine where in the rack the system is going to be installed by referring to the rack post drawing below.

**CAUTION!**

The mounting positions must be carefully measured so that rails can be mounted parallel to each other.

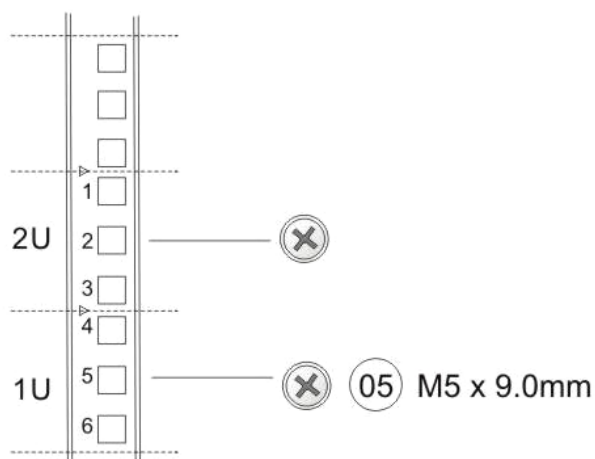
Step 2. Use the figures below to measure the relative locations of the cage nuts on the rack posts (if they do not have threaded holes). Attach two M5 cage nuts (#08) on each of the front rack posts.

On Front Rack Posts:

Rack-mount & Cage Nut Positions on a Front Rack Post

On Rear Rack Posts:

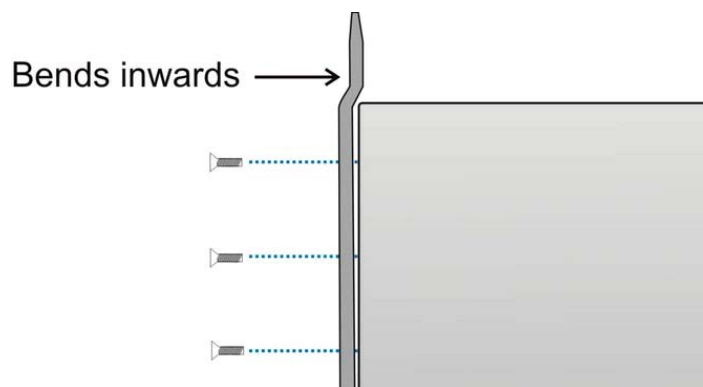
Rear rack posts



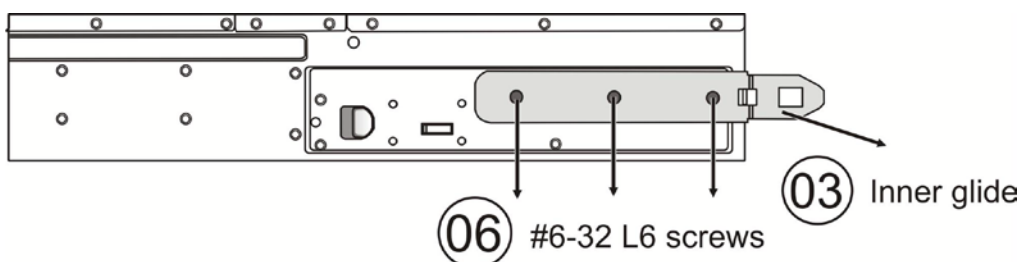
Mounting Holes on a Rear Rack Post

Step 3. Attach inner glides to the sides of chassis using the included screws.

When attaching the inner glides, orient them so that the slimmer part of the glides bends towards the center of chassis. If installed in a wrong orientation, you will not be able to install the chassis into the rack.

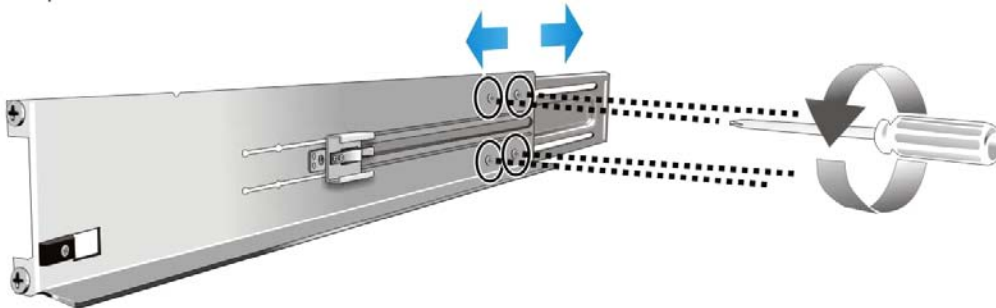


Inner Glide Orientation: Top View

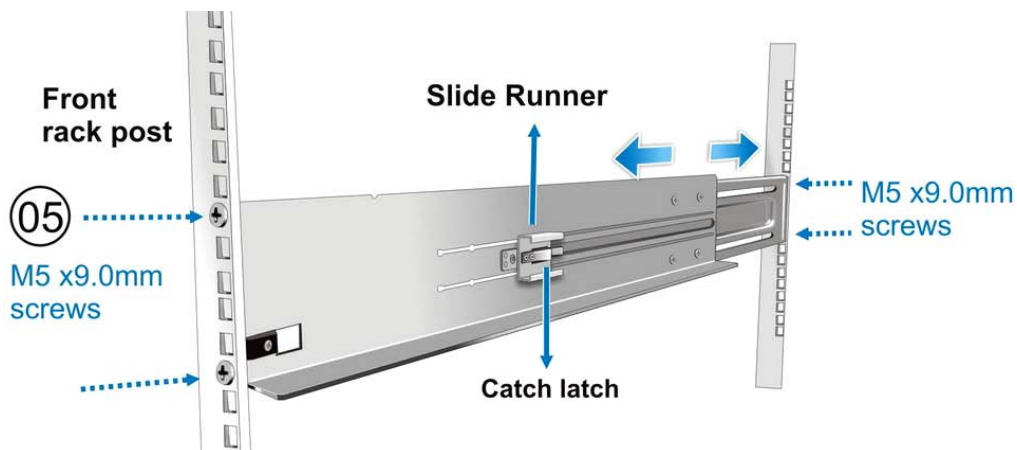


Attaching an Inner Glide

- Step 4.** Adjust the length of the rail assembly and make sure the bend of the L-shape rail (#01) faces inward. Loosen the four screws near the end of the L-shape bracket to adjust rail length. Fasten them when length adjustment is done.

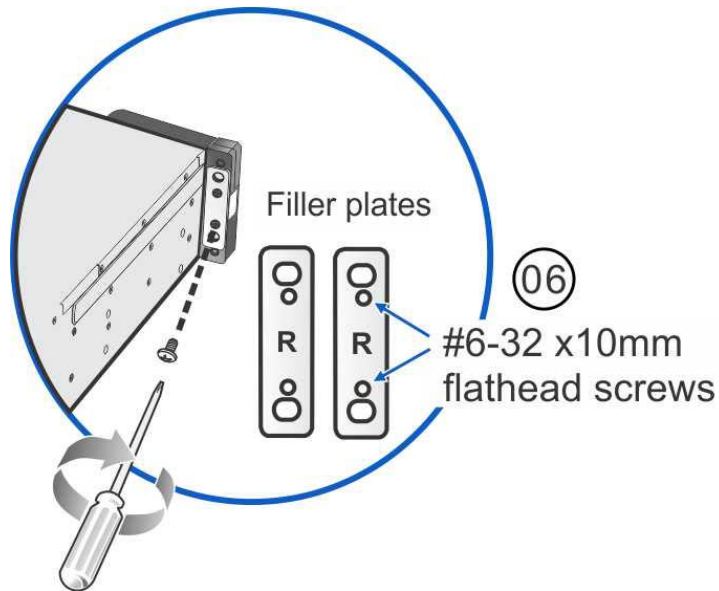


Adjust the Rail Length



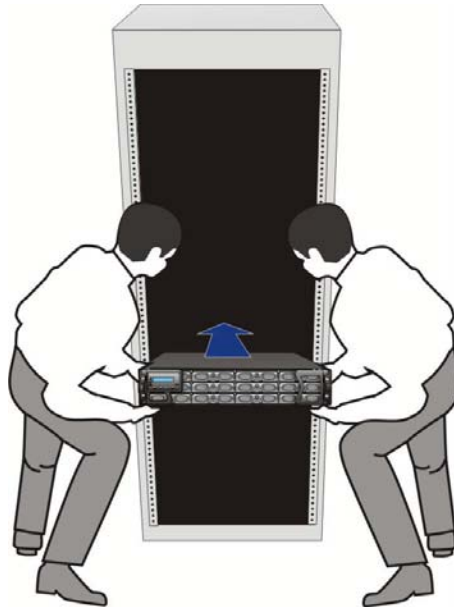
Fitting the Rail into Rack

- Step 5.** Position the front-end of a rail below the top cage nut. Secure the rail to the front and rear rack posts each using two M5 screws (#05). (See Component drawing above). Do not insert the screws into the cage nuts as cage nuts will be used to secure the enclosure later.
- Step 6.** Attach the filler plates (#04) and bezel mounting brackets behind the enclosure ears using the four #6-32 x 10mm flat head screws (#06).



Securing a Filler Plate behind Chassis Ears

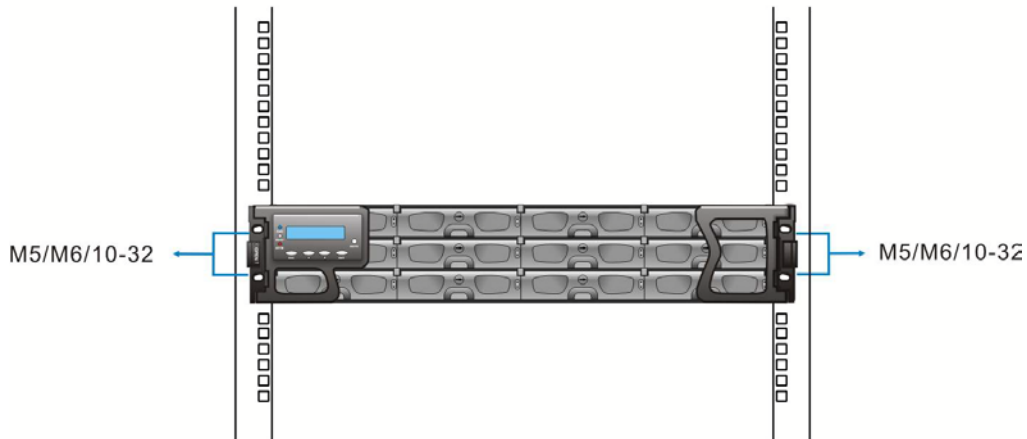
- Step 7.** Place the enclosure onto the rails and slide the enclosure into the rack until its chassis ears flush with the front rack posts. Two (2) people are required.



While pushing the chassis into the rack, make sure the tips of the inner glides fit into the U-shape brackets on the slide runners. A “click” sound will be heard when the inner glides catch the spring latches on the slide runners.

- Step 8.** Fasten four screws provided in your enclosure accessory box (M5, M6, or #10-32) through holes on the forearm handles.

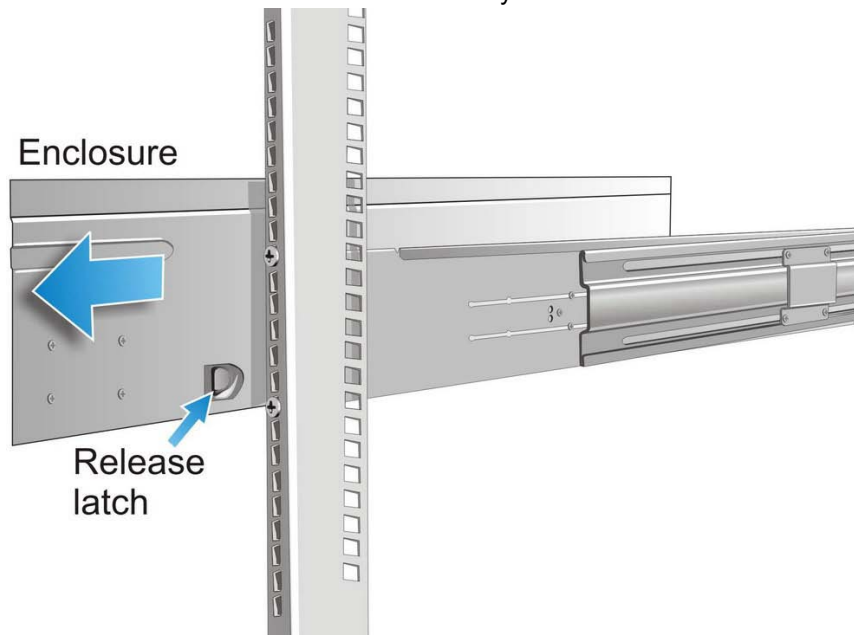
- Step 9.** Mount bezel over the face of the enclosure and secure with thumb screws



Removing Chassis

If you need to remove a chassis from the rack:

- Step 1.** Loosen bezel thumbscrews and remove bezel.
- Step 2.** Remove the screws fastened through the chassis ears. Pull the chassis out until it is stopped by the retention latches.
- Step 3.** Use both hands to support the weight of the chassis, and then use your index fingers to press and pull the release latches towards you.



Removing Chassis from Rack

- Step 4.** When the chassis is released, slowly pull the chassis from the rack. Another person should be helping you to remove the chassis from the rack.

2.7 Controller Installation

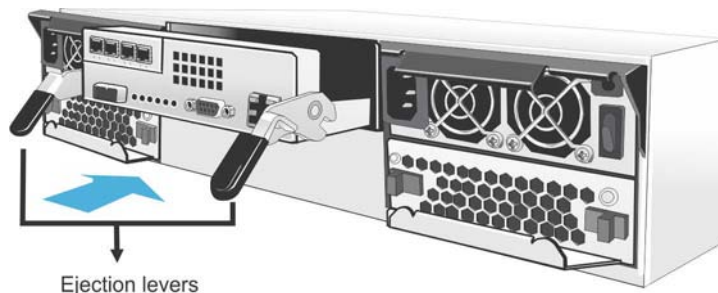
2.7.1 Installing a Controller Module



NOTE:

If you have a separately purchased CBM, install it before you install the controllers. Please refer to the *Installing CBM (Optional)* section in this chapter.

- Step 1. Wear an anti-static wrist strap.** When handling the controller, avoid touching circuit boards and connector pins.
- Step 2. Remove controller from the controller box.**
- Step 3. Align the controller module with the controller module bay, making sure that the levers are down. Gently slide the controller module in.**
- Step 4. Secure the connection.** When the controller is reaching the end and you feel the contact resistance, use slightly more force to mate the controller with backplane connectors. When the controller is almost fully inserted, use the ejection levers to secure the controller. The levers help ensure that the back-end connectors are properly mated.



Using Ejection Levers to Secure Controller

- Step 5. Fasten the retention screws.** Once fully inserted, secure the controller module to the chassis by fastening the retention screws through the holes underneath the ejection lever.
- Step 6. Continue with installing cabling and other components.**

2.8 Hard Drive Installation

Hard Drive Installation Prerequisites

Hard drives have been pre-integrated into the drive trays for the HDX4 DS system. If a hard drive has to be replaced follow this procedure. Before installing hard drives, the following factors should be considered:

Capacity (MB/GB): Use drives with the same capacity. RAID arrays use a “least-common-denominator” approach. The maximum capacity of each drive used in the array is the maximum capacity of the smallest drive. Choose big drives with the same storage capacity.

Profile: The drive trays accommodate 3.5-inch-wide x 1-inch-high hard drives.

Drive type: This model accommodates only certain 6Gb/s SAS or 3Gb/s SATA hard drives. Please contact technical support or sales to purchase replacement compatible disk drives.

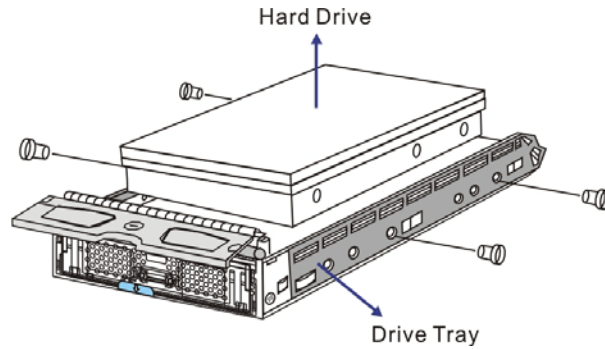


WARNING!

1. Handle hard drives with extreme care. Hard drives are very delicate. Dropping a drive against a hard surface (even from a short distance) and hitting or touching the circuit board on the drives with your tools may cause damage to the drives.
 2. Observe all ESD prevention methods when installing drives.
 3. Only use screws supplied with the drive cassettes. Longer screws can damage the hard drives.
-

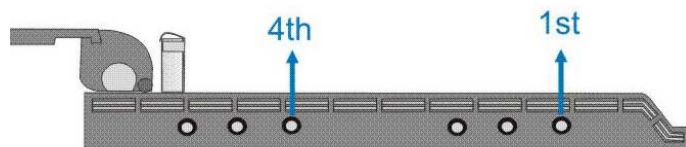
Drive Installation

- Step 1.** **Place the hard drive into the drive tray** (as shown below), making sure that the interface connector is facing the open side of the drive tray, and the label side facing up.



Installing a Hard Drive

- Step 2.** **Adjust the drive's location** until the mounting holes in the drive canister are aligned with those on the hard drive.



Mounting Hole Locations

- Step 3.** Secure the disk drive with four (4) of the supplied 6/32 flat-head screws.
- Step 4.** Once the hard drives are installed into drive trays, install all drive trays into the enclosure. See detailed instructions in the following section.

2.9 Drive Tray Installation

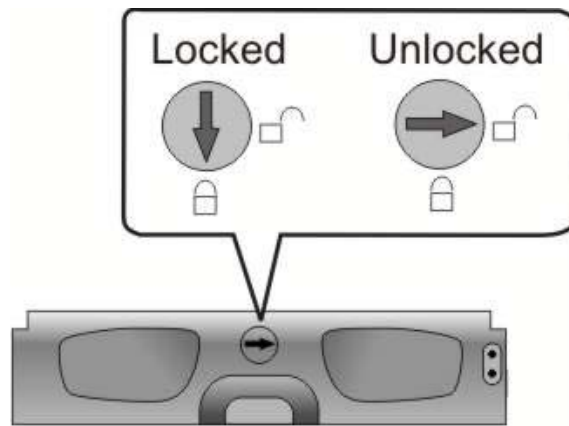
Once the hard drives have been secured within the drive trays, the drive trays can be installed into the system.



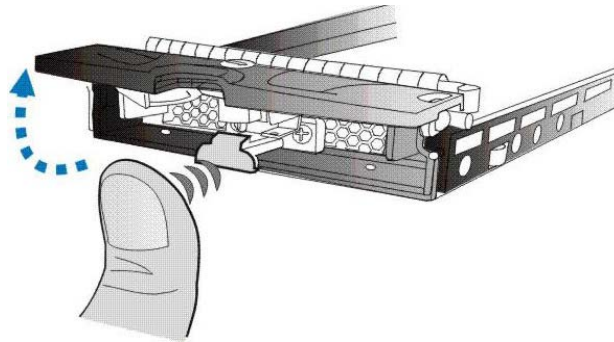
WARNING!

All drive trays must be installed into the enclosure even if they do not contain a hard drive. If there are empty drive bays, the ventilation airflow will be disrupted and the system will overheat.

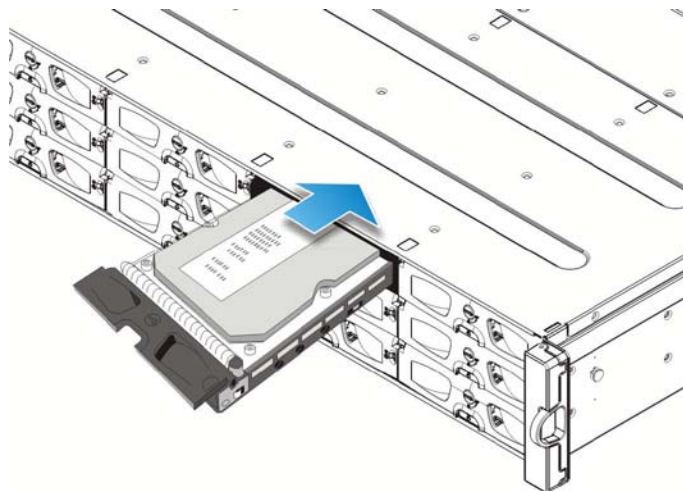
-
- Step 1.** Use a small-size, 1/8", flat-blade screwdriver to turn **the rotary bezel lock to the unlocked position**, i.e., the groove on its face is in a horizontal orientation.

**Front Bezel Rotary Lock**

- Step 2.** **Open the front bezel on the drive tray.** Push the release button on the drive tray. The front bezel will spring open.

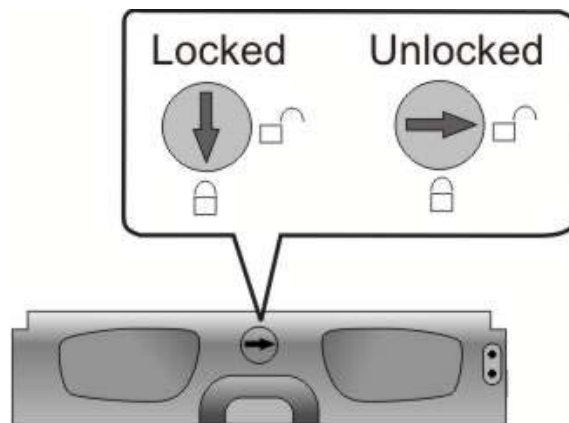
**Drive Tray Release Button**

- Step 3.** **Align the drive tray with a drive bay.** Gently slide it in until the drive tray reaches the end of the drive bay. This should be done smoothly and gently.

**Installing a Drive Tray**

Step 4. **Close the front bezel.** Make sure the front bezel is closed properly to ensure that the back-end connector is properly mated with the corresponding connector on the backplane. If the front bezel can not be closed properly, the connection between the hard drive and backplane may come loose and mysterious drive signals may result.

Step 5. **Lock the bezel into place** by turning the rotary bezel lock until the groove on its face is pointing down (vertical orientation).



Front Bezel Rotary Lock

Step 6. Once the drive bays are populated and the system is powered on, the RAID controller will automatically spin up the hard drives and recognize their presence.

2.10 Installing CBM (Optional)

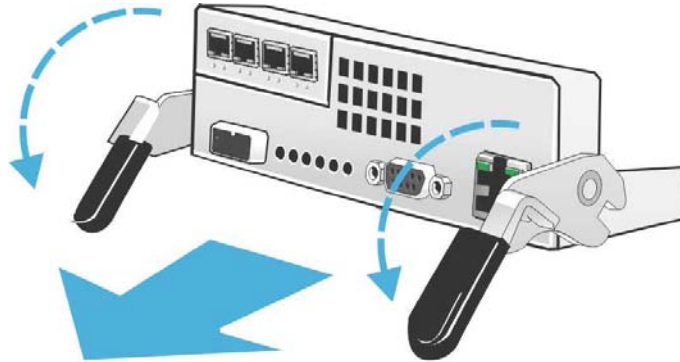
The CBM (Cache Backup Module) is an optional item for the single-controller Galaxy HDX4 system. If purchased, install the CBM on the arrival of your system before installing the RAID controller into the subsystem.

A CBM module contains a BBU (Battery Backup Unit) and a FBM (Flash Backup Module).

To install a CBM module (Skip steps 1-4 if installing CBM in a new system):

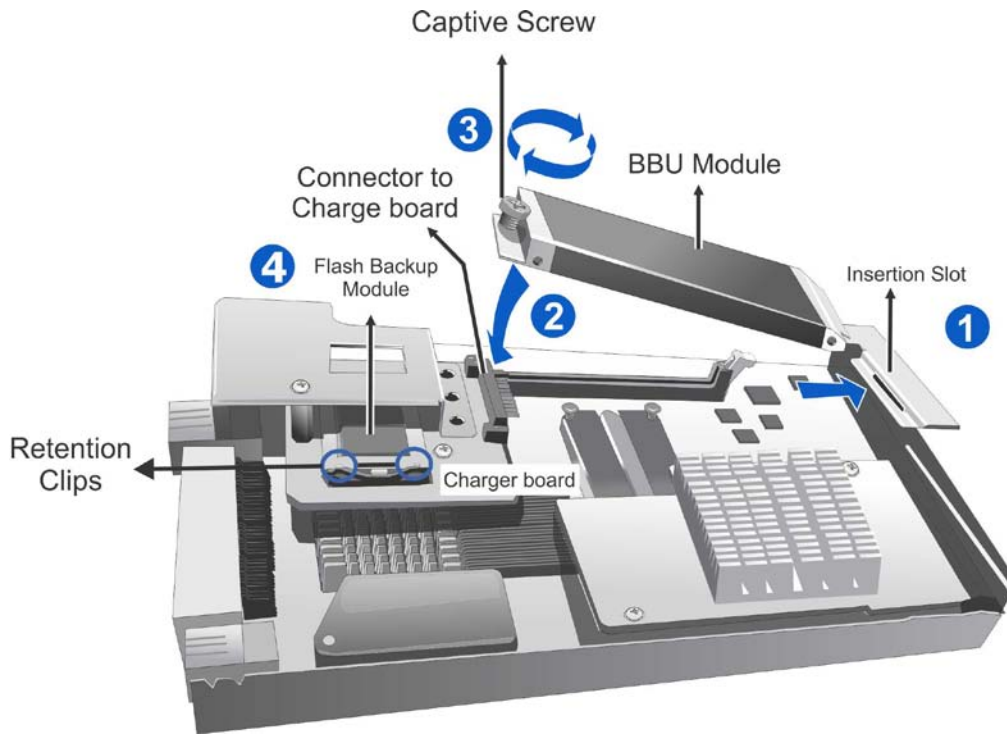
- Step 1.**
- 1-1. If a system is powered on, stop host I/Os.
 - 1-2. Use the **“Shutdown Controller”** command to flush cached data.
 - 1-3. Power down the system.
- Step 2.** Remove RAID controller from the chassis by loosening screws under the ejection levers.

- Step 3. Press down on the ejection levers. The controller will be eased out from chassis.



Press Down on the Ejection Levers

- Step 4. Place controller on a clean, static-free surface. Hold the controller by its metal canister. Never touch the circuit board or connector pins.
- Step 5.
- 5-1. Install BBU by orienting its protruding edge on one end into the insertion slot, and lowering it into the canister. The orientation is shown in the below figure. See **#1** in the figure below.
 - 5-2. Carefully orient the BBU so that the golden finger connector on the BBU is properly aligned with that on the charger board. There are guide pins on BBU to help properly align the connectors. See **#2** in the figure below.
 - 5-3. Once the connectors are mated, fasten the captive screw on the BBU to secure the installation. See **#3** in the figure below.



Installing CBM

- Step 6. The flash backup module installation is shown in **#4** in the figure above.
- 6-1. Install the flash backup module by orienting and inserting it at an approximately 15 degree angle into the SSD socket. The SSD socket is located on the charger board.
- 6-2. Make sure the SSD's golden fingers are fully inserted. Press the SSD down. The retention clips on the SSD socket will hold the module in place.
- Step 7. Install the RAID controller back into chassis. Insert the controller slowly into the module slot. When you feel the contact resistance by your hands, use more force, and then pull both of the ejection levers upwards to secure the controller into chassis.
- Step 8. Secure the controller by fastening the two (2) screws you previously removed to the ejection levers.

Chapter 3

System Connections

This chapter outlines some general configuration rules you should follow when configuring a storage system and introduces basic information about cabling and topologies for the iSCSI version of the Galaxy HDX4. You can refer to these topologies or use them as a guide for developing your own unique topologies. A complete description of the power on and power off procedures is also given in this chapter.

3.1 Connection Overview

3.1.1 Cabling

Following are the requirements for the type of cables used to connect the system's iSCSI host ports:

1. Ethernet cables are user-supplied. Cat5e shielded STP type network cables or better performance types (important for meeting the requirements imposed by emission standards). A shielded STP, twisted-pair cable is available as an accessory.
2. Straight-through Ethernet cables with RJ-45 plugs.
3. Use of cross-over cables can also be automatically detected and re-routed for a valid connection.

Connection:

1. Directly to iSCSI initiators (software or hardware) or via Gigabit Ethernet switches.
2. To servers equipped with iSCSI HBA – preferably a hardware TOE (TCP/IP Offload Engine) card, and then to client stations with an Ethernet NIC or iSCSI HBA.
3. The system presents its logical volumes through SCSI-like IDs and LUNs. These RAID volumes then appear as iSCSI targets through the network.



NOTE:

Even though iSCSI initiator software is a cost-effective way of building an iSCSI SAN, software initiator adds additional workload to the server CPU. It is recommended to apply iSCSI HBAs that come with TCP/IP offload engines in order to reduce overhead.



WARNING!

All cables must be handled with care. Make sure Ethernet cables do not run parallel with power cords. To prevent interference within a rack system, the cable routing path must be carefully planned and they must not be bent.

3.1.2 Network Topologies

The iSCSI host ports connect to Ethernet network devices and iSCSI initiators that comply with the IETF iSCSI standard (RFC 3720). Network connection of the iSCSI ports is flexible. The use of network connecting devices, subnet, Name Servers, or iSCSI management software can vary from case to case. In the following sections, configuration diagrams will be provided to illustrate the possible uses of the HDX4 system in an iSCSI network.

Note that host NIC ports and the storage system's iSCSI host ports must be configured into the same subnet.

3.1.3 Points of Failure

The primary concern for configuring host-side topologies is to avoid **points of failure**. It is therefore preferred that two HBA cards are installed on the host side. Data flow and access management should therefore be implemented to avoid access contention. RitePath MPIO software can be implemented in order to access a RAID volume through an alternate data link in the event of cabling failure.

3.2 Host Connection Topologies

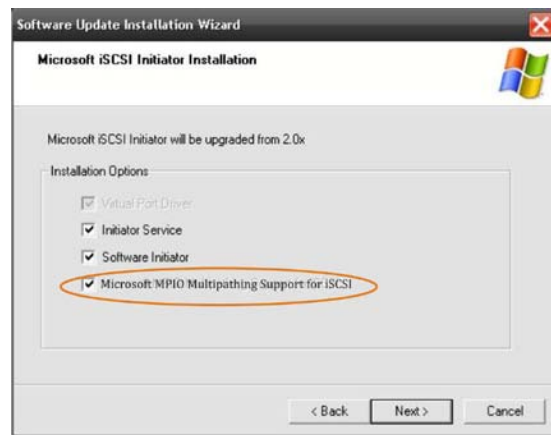
Note the following with the configurations diagrammed below:

1. Use the Ethernet management port for management purposes, i.e., Web GUI or telnet console. This Ethernet management port is not used for I/O transactions.

2. Configurations such as a subnet or Virtual LAN can separate iSCSI host links, decrease overhead, and eliminate the impact of link failure.
3. Multiple arrays or logical partitions can be created and made available separately through different IDs or LUN numbers on the host ports. Usually, a RAID5 logical drive of eight (8) members often brings optimal array performance. You may attach expansion enclosures to expand system capacity.

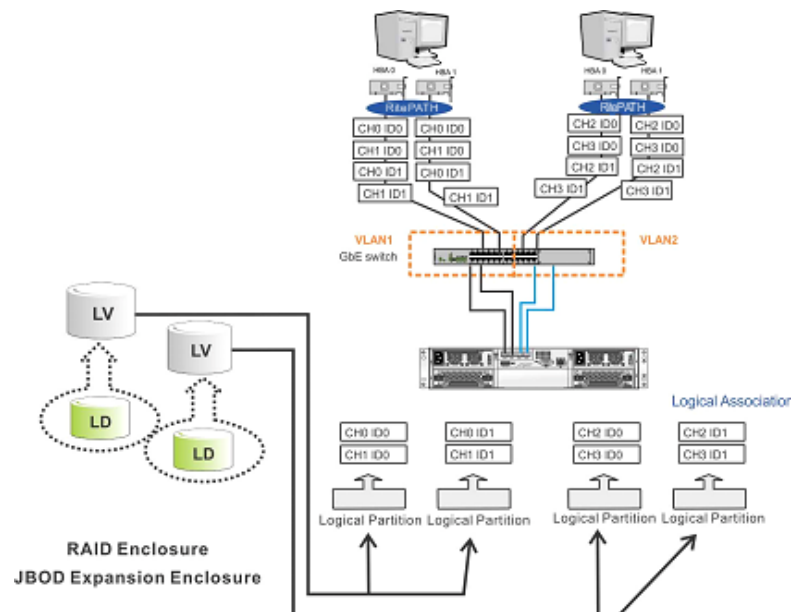
**NOTE:**

If you are using the Microsoft's software initiator, please select the embedded **MPIO** function when installing the software, as the MPIO selection creates conflicts with the Galaxy RitePath MPIO driver.



3.2.1 Sample Topology – Single-controller with Fault-tolerant Paths

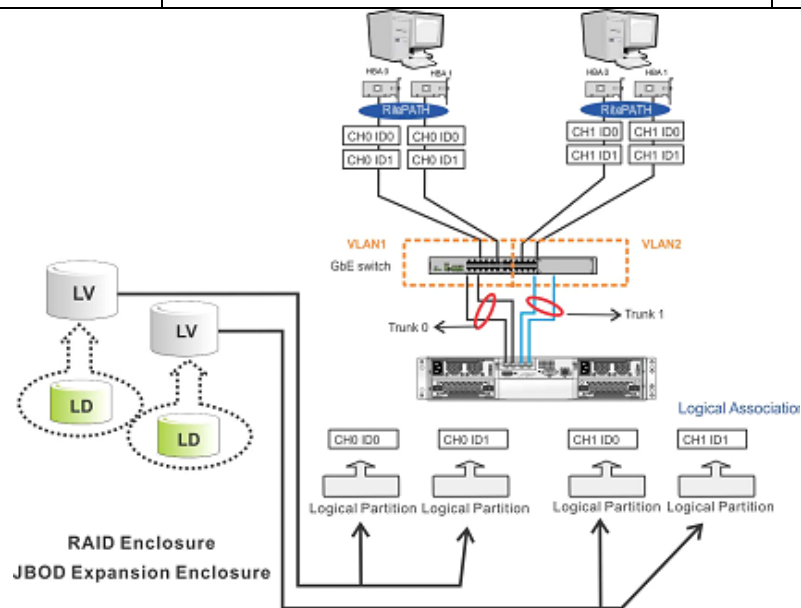
Component	Description	#
HDX4 RAID system:	iSCSI RAID managed by a single controller, with 4 host ports	1
HBA or NIC	iSCSI initiators, preferably PCI-E TOE cards	4
GbE cables	GbE network cables	8
Software	RitePath to manage the fault-tolerant paths with failover/failback and load balance	2
RAID configuration	<p>4 Logical partitions (created from 2 logical volumes)</p> <p>2 Logical Volumes (each contains a logical drive)</p> <p>2 Logical Drives</p> <p>* Each logical partition appears on two different host links for the purpose of fault tolerance. Use RitePath multi-pathing software so that your operating system can identify alternate paths to the same logical drive.</p>	



Sample Topology: Single-Controller with Fault-tolerant Paths

3.2.2 Sample Topology – Single-Controller with Trunks

Component	Description	#
HDX4 RAID system:	iSCSI RAID managed by a single controller, with 4 host ports	1
HBA or NIC	iSCSI initiators, preferably PCI-E TOE cards	4
GbE cables	GbE network cables	8
Software	RitePath to manage the fault-tolerant paths with failover/failback and load balance	2
RAID configuration	<p>4 logical partitions (created from 2 logical volumes)</p> <p>2 Logical Volumes (each contains a logical drive)</p> <p>2 Logical Drives</p> <p>* Each logical partition appears on two different host links for the purpose of fault tolerance. Use RitePath multi-pathing software so that your operating system can identify alternate paths to the same logical drive.</p>	



Sample Topology: Single-Controller with Port Trunks

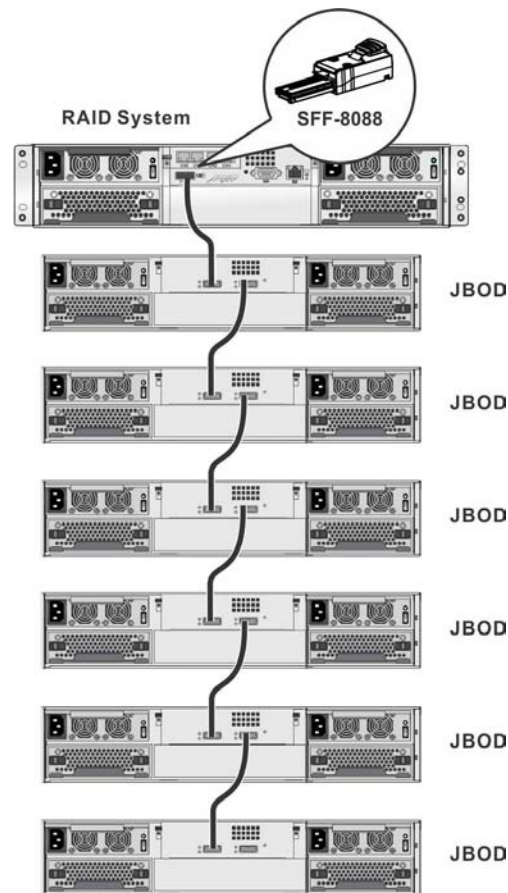
iSCSI Topology and Host LUN Mapping:

Configuration Details:

1. A logical drive can be associated with several SCSI IDs on separate channels making it a RAID volume accessed through different data paths. The default ID on every host channel is ID#0. More can be created if the need arises.
2. You can manually include or exclude specific iSCSI initiators from the access list to your iSCSI arrays. A number of access conditioning factors can be included: IQN, NetMask value, CHAP, and IP addresses can be associated with a RAID array (a logical drive). In this way, only the authorized host adapters or NICs can access your arrays.
3. Subnet and Virtual LAN can be created to reduce overheads, to contain broadcast, and provide access security. LAN configuration is beyond the scope of this hardware manual.
4. Multiple arrays or multiple partitions can be created and made available separately through different IDs or LUNs on the host ports. The RAID volumes appear as shared storage over the Ethernet network.
5. To ensure optimal performance, make sure you connect the iSCSI RAID to a high speed Gigabit Ethernet network. It is recommended you share the iSCSI storage over a dedicated Ethernet network instead of sharing it on a clients' network.

3.3 Expansion Links

Expansion enclosures, i.e., Rorke's Galaxy HDX4 12 or 16 bay JBODs, are connected with the subsystem through the SAS Expansion port. Please see the figure below for the physical connections of the JBODs and the subsystem. For the connection between the RAID and the JBOD, you should use an SFF-8088 to SFF-8088 SAS cable. As to the connection between JBODs, you should use SFF-8088 to SFF-8088 SAS cables.



Connecting JBODs to the System

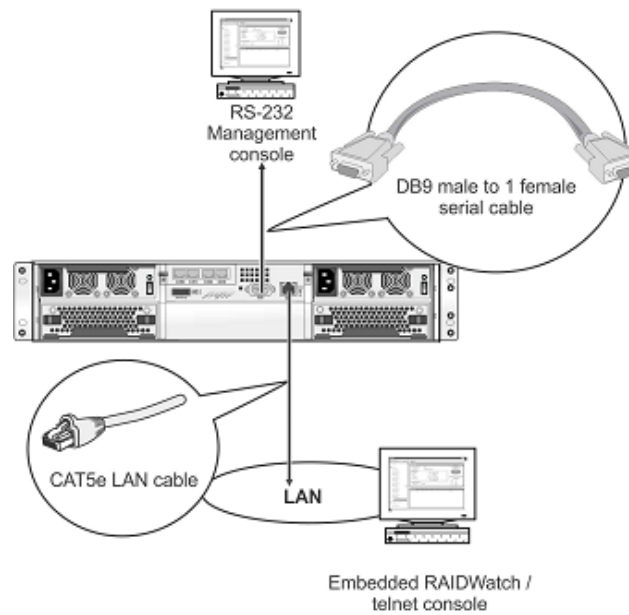
Enclosure ID Settings:

- The configurable IDs start from 1 to 6. Usually the numbering starts from the one closest to the managing RAID enclosure.
- The subsystem can connect to a maximum of **six (6)** JBODs.
- Make sure a unique ID is configured on each JBOD so that the SAS WWN addresses of disk drives can be properly assigned. RAID system firmware automatically manages these addresses.



Setting the Enclosure ID

3.4 Connecting Other Interfaces



Connecting Serial Port and Ethernet Ports

Serial cable and LAN cable are user-supplied. Use an ordinary straight-through cable or a USB-to-DB9 converter cable. No null modem or pin-swap is required.

Use a straight-through serial cable or a USB-to-DB9 converter cable.

The serial port's defaults are:

Baud rate	38400
Data bit	8
Parity	none
Stop bit	1
Flow control	Hardware

Serial Port Defaults

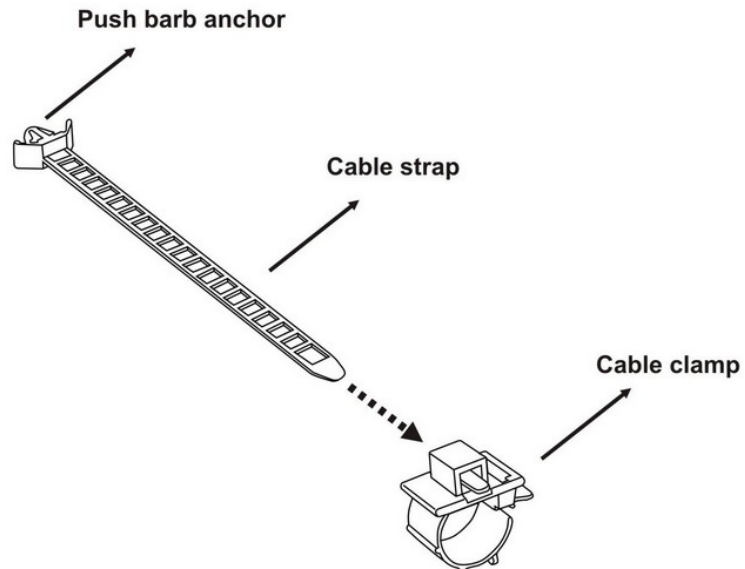
For TCP/IP connection and firewall configuration with a management station running Web GUI, please refer to Web GUI's User's Manual. If your environment has no DHCP server, a default IP, <192.168.1.129> can be used to make an access for the first time.

3.5 Connecting Power Cords

Use the included cable clamps to secure power cord connections.

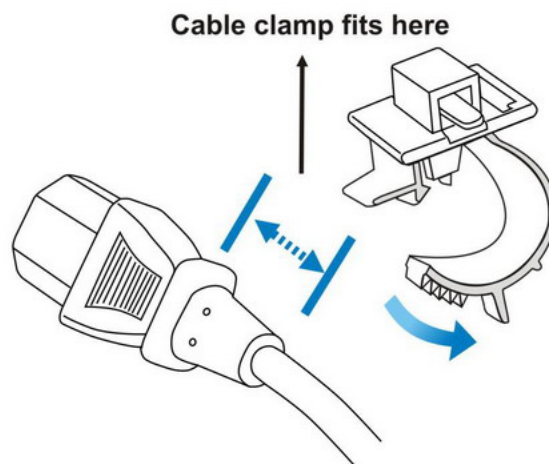
Step 1. Remove power cords and cable clamps from the accessory boxes.

Step 2. Combine cable straps with cable clamps.



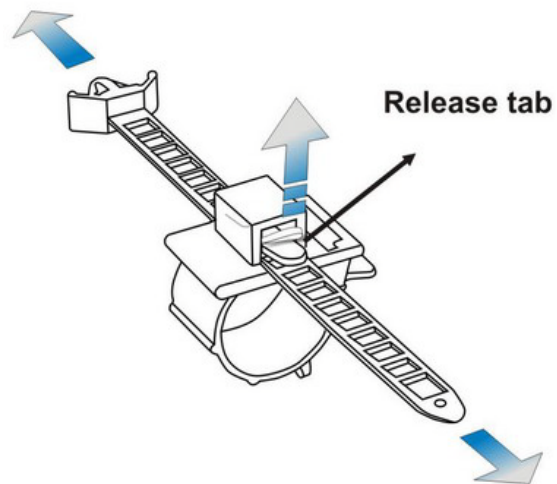
Combining Cable Strap and Cable Clamp

Step 3. Attach cable clamps to the power cords by opening and unwrapping the plastic ring around the base of power cords.



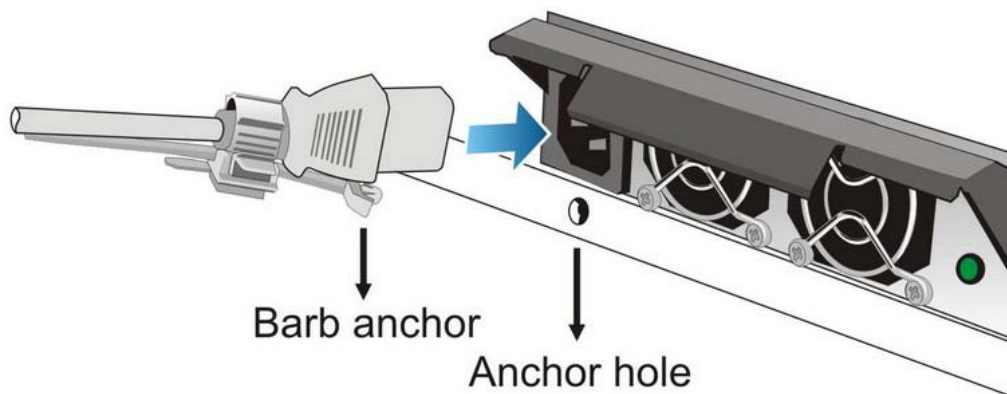
Attaching Cable Clamps to Power Cords

Step 4. Adjust the position of cable straps using the release tab. Adjust the position so that when a power plug is connected to system power the barb anchor can be inserted into the anchor hole above the power socket.



Adjust Cable Strap Position

Step 5. Connect power cords to system power supplies and insert the barb anchor into the anchor holes below the power sockets.



Attaching Power Cords

3.6 Power On

Once all the components have been installed in the HDX4 DS system and the iSCSI ports have been connected to the network, power on the network devices, the system, and then power on the servers/iSCSI initiators.

Check List

BEFORE powering on the system, please check the following:

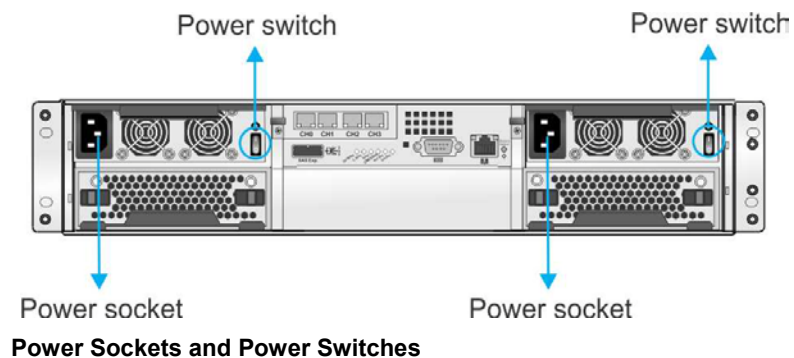
- ☐ **CBM (optional):** Make sure the CBM has been installed correctly (if CBM has been purchased).
- ☐ **Hard drives / Drive trays:** All the drive trays have been installed into the system.
- ☐ **Cable connections:** The system has been correctly connected to host computer(s), management computers, and JBODs.

- ❑ **Power cords:** The power cords have been connected to the PSUs on the system and plugged into the power source.
- ❑ **Ambient temperature:** All the system components have been acclimated to the surrounding temperature.

Power On Procedure

When powering on the HDX4 DS system, please follow these steps:

- Step 1. Power on expansion JBODs.** If a multi-enclosure configuration is applied, power on the expansion enclosures.
- Step 2. Power on the network connection devices.**
- These devices include the Ethernet switches, routers, and any other such devices that have been connected to the iSCSI HDX4 system. Please refer to the documentation that came with your network devices for the power on procedures.
- Step 3. Power on the HDX4 DS system.**
- The system should only be powered on after all the network connection devices have been powered on. Consult your network administrators for proper network configurations. To power on the subsystem, turn on the two power switches located on the rear panel of the subsystem. Each switch controls a single PSU, therefore make sure that both switches are turned on.



- Step 4. Power on the initiators.**
- The servers or iSCSI initiators should be the last devices that are turned on. Please refer to the documentation that came with your application servers to see their own power on procedures.

**CAUTION!**

Although the PSUs are redundant and a single PSU can provide sufficient power to the system, it is advised to turn on both power supplies. If only one (1) PSU is operating and if that PSU fails, system downtime will occur.

Power On Status Check

Once the system has been powered on, you should begin verifying system status via the following monitoring interfaces:

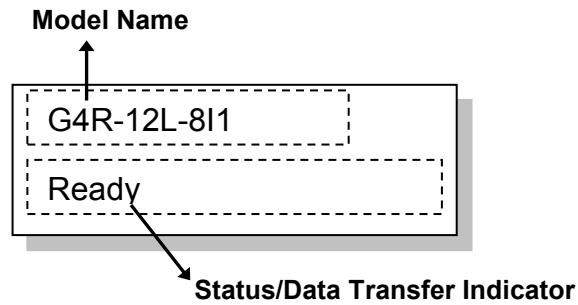
1. **Controller LEDs:** The Controller Ready, Host Busy, and Drive Busy LEDs should all flash green during the initialization process.
2. **Drive tray LEDs:** The blue status LEDs on all drive trays that contain a hard drive should light up showing that power is supplied to the disk drives.
3. **LEDs on LCD keypad panel:** The Power LED on the LCD panel should light blue; the ATTEN LED should be flashing red during the initial stage and turn off once the initialization is completed.
4. **Host port LEDs:** The Link LED near the host ports should illuminate yellow, indicating successful connection has been established.
5. **PSU LEDs:** If the PSU is operating normally and experiencing no problem after being powered on, the LEDs on the PSU should light green.
6. **Firmware and Web GUI:** Once the system has been successfully initialized, you may examine details of the operating statuses using the firmware-embedded utility or the Web GUI software suite.
7. **Audible alarm:** If any errors occur during the initialization process, the onboard alarm will sound in a quickly repeated manner.

**NOTE:**

The Galaxy HDX4 DS system has been designed to run continuously. Except for the controller, many component failures can be corrected online.

LCD Screen

When powering on the system, wait for the front panel LCD screen to show “READY” or “No Host LUN” before you power up the application servers.



The LCD Startup Screen

The LCD screen startup sequence is shown and described in the sequence below:

Initializing... Please Wait...	This screen appears when the PSUs are turned on.
Power On Self Test, Please Wait	System is performing a self-test.
Power on Init Completed..	The self-test has been completed.
G4R-12L-8I1	System is accessing various interfaces.
G4R-12L-8I1 1GB RAM, Wait..	Verifying the installed cache memory.
G4R-12L-8I1 No Host LUN	System is ready. You can now start host LUN mapping by using the system's firmware or Web GUI software management suite.
G4R-12L-8I1 Ready	When host LUN mapping has been completed, system is ready for I/Os.

Power Off Procedure

To power down the HDX4 DS system, please follow these steps:



CAUTION!

If you have RAID expansion storage attached to your Galaxy RAID, it is very important that you power off the RAID first and then the JBODs. Possible loss of data may occur if you power off the JBODs first.

Secondly, you must power up the JBODs first, have them come ready and then power up the RAID. Possible loss of data may occur if you power up the RAID first.



NOTE:

If you wish to power down the system, please make sure that no time-consuming processes, like a “logical drive parity” check or a “background scrub,” are running.

Step 1. Stop I/O access to the system.

Close your applications to stop all I/O accesses to the subsystem. Please refer to the documentation that came with your applications.

Step 2. Flush the cache.

Locate the **C_Dirty** LED on the controller module to check if there is still cached data in memory. Use the “**Shutdown Controller**” firmware function to flush all cached data. This prepares the RAID subsystem to be safely powered down.

Step 3. Turn off the power.

Power off the subsystem using the power switch on each PSU. Once the subsystem is powered down, other devices/enclosures that are connected to the subsystem can be sequentially powered down.

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Chapter 4

System Monitoring

4.1 Overview

The system is equipped with a variety of self-monitoring features that help keep system managers aware of system operation statuses.

The monitoring features include:

- **Firmware:** The RAID controller in the system is managed by a pre-installed firmware, which is accessed using a PC hyper-terminal via the COM1 serial port. Device statuses can be obtained from the menu-driven configuration utility. Firmware features are fully described in the **Operation Manual** that came with your system.

The first screenshot shows the Main Menu with the following options: Quick installation, view and edit Logical drives, view and edit logical Volumes, view and edit Host luns, view and edit Drives, view and edit channels, view and edit Configuration parameters, and view and edit Peripheral devices. The 'view and edit Peripheral devices' option is selected, leading to a table of I2C Peripheral Device status.

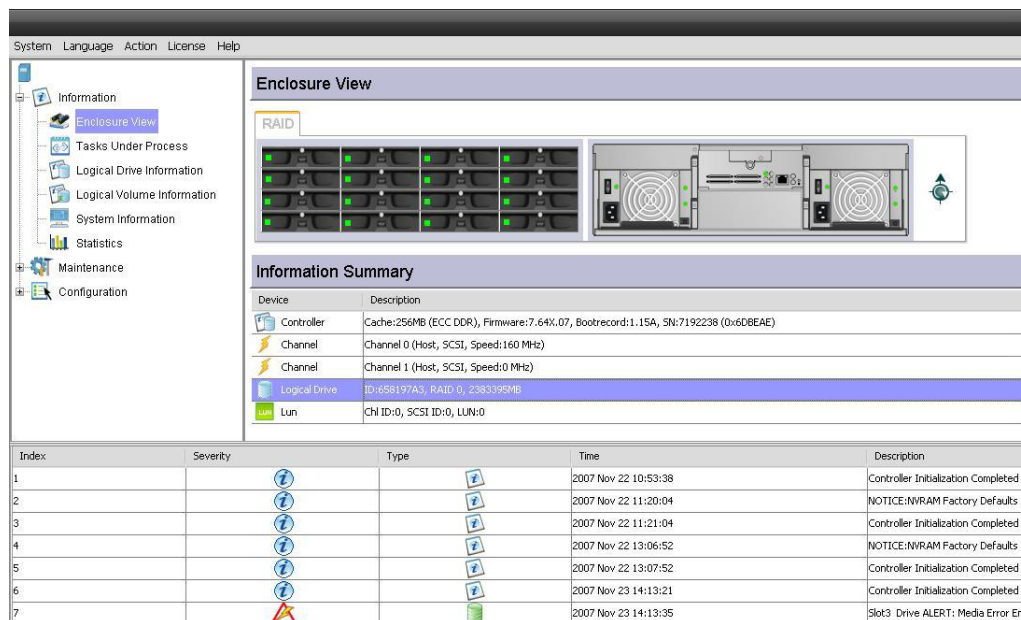
ITEM	STATUS	LOCATION
I2C Peripheral Device	Operational	

Below the table, 'Device Set 0' is selected, leading to a list of parameters: Power Supply, Cooling Fan, Temperature Sensor, Voltage Sensor, Drive Failure Output Definition, and Device Set Descriptor. The 'Voltage Sensor' option is selected.

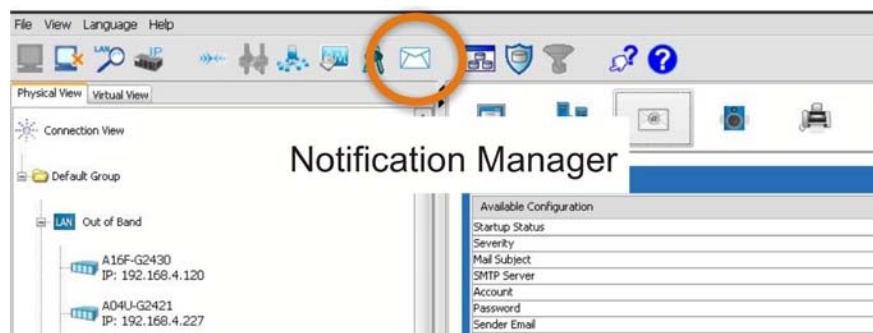
The second screenshot shows the 'Controller Peripheral Device Configuration' menu with the 'View Peripheral Device Status' option selected, leading to a table of Voltage and Temperature Parameters.

ITEM	VALUE	STATUS
+3.3V Value	3.384 V	Operation Normal
+5V Value	5.099 V	Operation Normal
+12V Value	12.564 V	Operation Normal
CPU Temp Sensor	51.5 (C)	Within Safe Range
Board1 Temp Sensor	37.0 (C)	Within Safe Range
Board2 Temp Sensor	40.5 (C)	Within Safe Range

- **Galaxy Array Manager:** Galaxy Array Manager is a fully integrated, Java-based, Graphical User Interface (GUI) that came with the system and can be used to monitor and maintain the subsystem locally or remotely over TCP/IP network. The management session is made using the 10/100BaseT Ethernet management port. Please refer to the **Galaxy Array Manager User's Manual** for further details.



Use GAM's **Notification Manager** to set up automated event notification via Email, MSN, LAN broadcast, etc.



- **LEDs:** LEDs are located on all modules. These LEDs indicate the integrity of a given component or a host/management link. You should become familiar with the various LEDs and their definitions.
- **Audible alarm:** An audible alarm is present on the system controller board and will be triggered if any of a number of threatening events occurred.

4.2 Status-indicating LEDs

4.2.1 LED Overview

All FRUs (Field Replaceable Units) have status-indicating LEDs that reflect the operational status and integrity.



NOTE:

The expansion link status is indicated by the LEDs on the JBOD controllers.

4.2.2 LCD Keypad Panel

The LCD keypad consists of five (5) buttons, three (3) LEDs, and a 16x2-character LCD screen that provides access to firmware-embedded utility. Press the **ENT** button for two (2) seconds on the initial screen to enter the main menu. Press the **ESC** button to skip the current event.

Function Keys:

Press the **UP** and **DOWN** arrow keys to select viewing items. In the bottom row of the main menu, “View and Edit Event Logs,” the most recent event is displayed.

Browsing Events:

To see detailed description of each event, use the arrow keys to select an event, and press and hold down the **ENT** key until a short beep sound is heard, then use arrow keys to browse through the description lines. If you tap the **ENT** key lightly, system will prompt you to delete event. Press **ESC** to return to the previous menu level.

Mute Button:

The **MUTE** button silences the alarm temporarily until the next event occurs.

The definitions of LEDs on the panel are given below.



LCD Keypad Panel

Name	Color	Status
PWR (Power)	Blue	ON indicates that power is supplied to the system, and system state is normal. OFF indicates that no power is supplied to the system or the RAID controller has failed.
BUSY	White	FLASHING indicates that there is active traffic on the host/drive channels. OFF indicates that there is no activity on the host/drive channels.
ATTEN (Attention)	Red	ON indicates that a component failure/status event has occurred. OFF indicates that the subsystem and all its components are operating correctly.

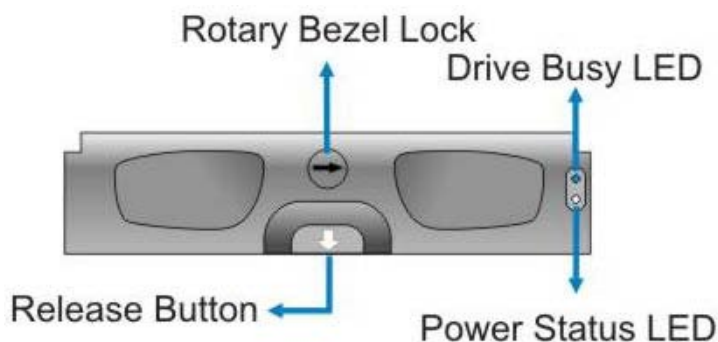
LCD Panel LED Definitions

**NOTE:**

During the power-on process, the ATTEN LED will light up steadily. Once the subsystem successfully boots up with no faults, the ATTEN LED will turn off.

4.2.3 Drive Tray LEDs

Two (2) LED indicators are located on the right side of each drive tray. When notified by a drive failure message, you should check the drive tray indicators to find the correct location of the failed drive. Replacing the wrong drive can lead to failure of two members of a logical array (RAID 3/5) and thus destroy data in it.



Drive Tray LEDs

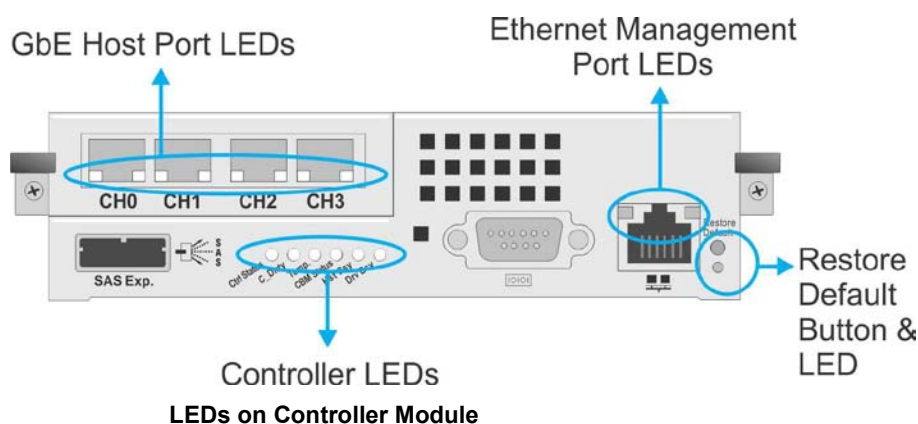
Name	Color	Status
Drive Busy	Blue	FLASHING indicates data is being

		written to or read from the drive. The drive is busy. OFF indicates that there is no activity on the disk drive.
Power Status	Green/ Red	GREEN indicates that the drive bay is populated and is working normally. RED indicates that the disk drive has failed, or a connection problem occurred.

Drive Tray LED Definitions

4.2.4 LEDs on Controller Module

The LEDs on the rear-facing faceplate of the RAID controller are shown below. The definitions are shown below.



LEDs on Controller Module

4.2.5 Controller LEDs

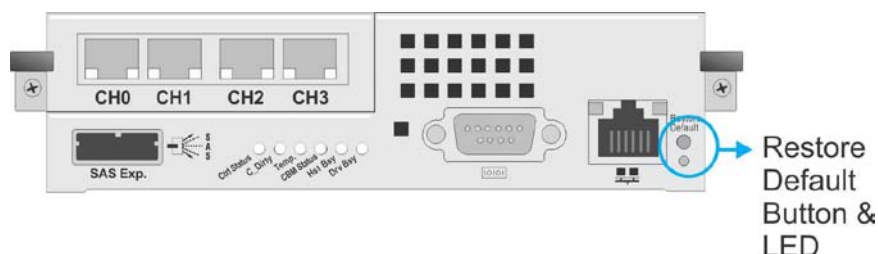
See the table below for an overview of controller LED definitions.

Name	Color	Status
Ctlr Status	Green/ Amber	Green indicates that a RAID controller is operating healthily. Amber indicates that a component failure has occurred, or inappropriate RAID configurations have caused system faults. It is also lit during the initialization process.
C_Dirty	Amber	ON indicates the following: <ul style="list-style-type: none"> - Cache Memory is dirty. - Data in flash backup module is being flushed to cache.

		<ul style="list-style-type: none"> - Errors occurred with cache memory (ECC errors). - Data is being flushed from flash backup module to drive (when power is restored). - Battery voltage is lower than 2.5V. - Battery temperature reading is abnormal (out of the 0 to 45°C range). - Battery is not present. <p>Blinking indicates that the system is writing cached data to flash backup module during power outage. Once done, LED is turned off.</p> <p>OFF indicates that the cache is clean, and that the battery backup unit is capable of sustaining memory in case of power loss.</p> <p>This signal is local to each controller.</p>
Temp.	Amber	<p>ON indicates that the detected CPU/board/chassis temperature has exceeded the higher temperature threshold.</p> <p>OFF indicates that the detected temperature reading is within the safe range.</p>
CBM Status	Green/ Amber	<p>Green steady on indicates the CBM module is ready. Both a BBU and flash backup module are present.</p> <p>Amber steady on indicates CBM failure, meaning either BBU or flash has failed.</p> <p>Blinking means a BBU is being charged.</p> <p>OFF means CBM is not installed in a single-controller "G" model.</p>
Hst Bsy	Green	Rapidly Blinking to indicate traffic on the host bus.
Drv Bsy	Green	Rapidly Blinking to indicate traffic on the drive channels.

Controller LED Definitions

4.2.6 Restore Default LED



Restore Default Button & LED

Restore Default	Green	<p>Lit Green to indicate the RAID configuration default has been successfully restored. The LED state will be invalidated after a few seconds.</p> <p>See below for how to use the push button.</p>
------------------------	--------------	--

Restore Default LED Definition

How to Use the Restore Default Button?



CAUTION!

The Restore Default button should be considered as a last-resort function. Although restoring firmware defaults will not destroy the existing logical drives, detailed configurations such as various parameters and host LUN mappings will be erased.

There is a non-latch type push button accessed through an opening on the controller faceplate.

Why restoring defaults?

1. Some of the latest firmware updates may be incompatible with the firmware currently running on your system. These updates may require restoring firmware defaults before firmware upgrade can actually take place.
2. Firmware has an embedded 2GB threshold for internal settings such as the supported no. of logical drives. When you upgrade controller DIMM module, say, from 2GB to 4GB, you need to restore firmware defaults after you upgrade your DIMM module size to 4GB.
3. Another condition that requires restoring defaults is when a system administrator forgets the password controlling the access to a RAID system. Before pushing this button, also practice the steps listed above. You can access configuration screen and manually record array information even without a password.

Listed below are the necessary procedures that should be completed before using this button:

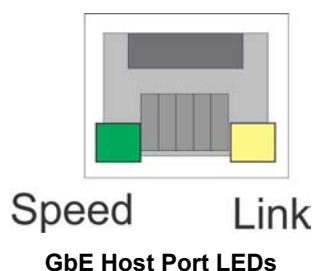
1. Stop host I/Os.
2. Before pressing this button to restore firmware defaults, it is highly advised to save your current configuration using the **“Save NVRAM”** function in firmware utility or the Web GUI.
3. You may also make a list of the existing ID/LUN mapping information. You will need the list for restoring ID/LUN mapping after restoring defaults. Default restoration will erase the ID/LUN mapping associations (e.g., which logical drive is associated with which host ID/LUN), and it will be necessary to restore the previous settings using the **“Restore NVRAM from Disks”** or **“Restore NVRAM from Files”** functions. Configurations such as ID/LUN mapping will be restored after a system reset.

How to use the button?

After the system is powered down, you can use a straighten paper clip to press the button. Press and hold the button down, power on the system, and wait for the associated LED and the system Ready LED to light up. The “Restore Def.” LED and the firmware “Default Restored” event message will indicate a successful restoration of firmware defaults.

4.2.7 GbE Host Port LEDs

Four (4) GbE host ports, which provide different connection speeds, are located on the controller faceplate. Shielded Cat5e straight-through Ethernet cables can be used to connect the RJ-45 ports to the network. Two (2) LEDs located on each port indicate the Ethernet connection speed and link status. See the diagram below for the locations of the two (2) LED indicators.



Name	Color	Status
Speed	Green	ON indicates currently connected with GbE speed

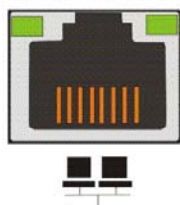
		OFF means connected with 10/100 speed.
Link Status	Yellow	ON indicates the port is linked. BLINKING indicates active transmission.

GbE Host Port LED Definitions

4.2.8 Ethernet Management Port LEDs

A shielded Ethernet cable is recommended for connecting the RJ-45 Ethernet management port to a local network after you configure an IP address. This enables you to manage your system via LAN or WAN. Two (2) LEDs on the Ethernet port indicate connection statuses. Refer to the table below for the LED definitions.

Link Activity



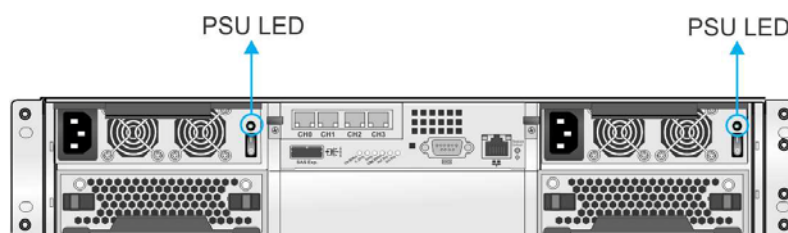
LAN Port LEDs

Name	Color	Status
Link Status	Green	ON indicates the management port is connected to a node or networking device.
LAN Activity	Green	BLINKING indicates active transmission

LAN Port LED Definitions

4.2.9 PSU LEDs

Each PSU comes with a LED (see the figure below) located near the power switch. This LED indicates the operational status of the PSU. Please refer to the PSU LED definitions shown in the table below.

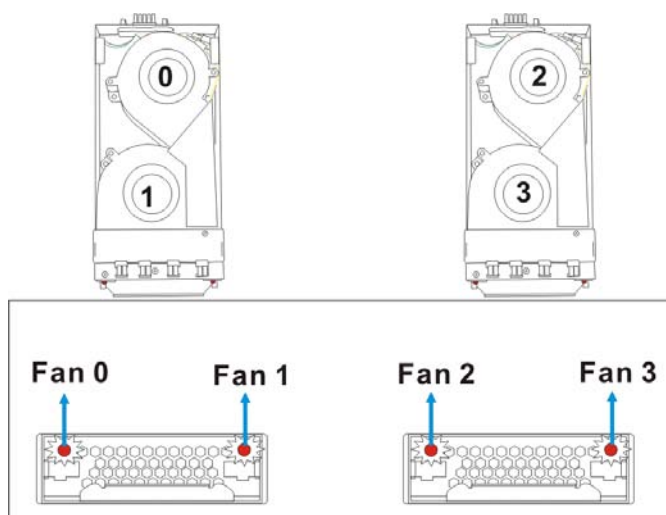


PSU LED

Color	Status
Intermittent Flashing Green	The power supply has not been turned on. The PSU LED flashes when the subsystem is connected to a power source but not yet turned on.
Static Green	The PSU is operating normally.
Static Red	The PSU has failed and is unable to provide power to the subsystem.

PSU LED Definitions**4.2.10 Cooling Module LEDs**

Each cooling module has two (2) red LEDs. Each LED corresponds to an individual cooling fan (See the figure below). Please refer to the cooling module LED definitions shown in the table below.

**Cooling Module LEDs and Cooling Fan Locations**

Color	Status
Static Red	OFF: The cooling fan operates normally. ON: The cooling fan has failed.

Cooling Module LED Definitions

4.3 Audible Alarm

4.3.1 Overview

Different environmental and operational parameters (like temperature, etc.) have been assigned a range of values between which they can fluctuate. If either the upper or lower thresholds are exceeded, an audible alarm will be triggered. The alarm will also be triggered when a component fails. If the system administrator is onsite and hears an alarm, the manager must read the error message on the terminal or Web GUI screen to determine what has triggered the alarm. After determining what has occurred, a system administrator must take appropriate actions to rectify the problem.

The Alarm beep pattern is described in the **Troubleshooting Guide** included in your product utility CD.



WARNING!

If an alarm is triggered it is necessary for you to determine the problem. If the audible alarm is ignored and the problem is not rectified, unexpected damage may occur.

4.3.2 Alarm Triggers

If any of the following components fails, the audible alarm will be triggered:

- RAID controller
- Cooling module
- PSU
- CBM
- Hard disk drives
- Sensors and presence detection circuits

4.3.3 I²C

The operating statuses of PSU and cooling fan modules are collected through an I²C serial bus. If either of these modules fails, the failure will be detected and you will be notified through the various methods described above.

Chapter 5

System Maintenance

5.1. Overview

5.1.1 Maintenance



WARNING!

Do not remove a failed component from the system until you have a replacement on hand. If you remove a failed component without replacing it, the internal airflow will be disrupted and the system will overheat.



CAUTION!

1. Do not insert a controller module from either HDX4 DS or HDX3 enclosures. A controller from another enclosure may have acquired a system serial number from system EEPROM, and could have used the serial number to generate a unique controller ID. As the result, you may encounter SAN problems with identical port names on multiple systems.
2. Do not use a PSU or cooling module from HDX3 or HDX4 DS series. They look similar. However, they may come with cooling fans with different rotation speeds, and may not be sufficient for your HDX4 DS models.

All of the following components can be replaced in case of failure:

1. Controller module
2. Memory module
3. CBM module
4. PSU modules
5. Cooling fan modules
6. Hard disk drives

5.1.2 General Notes on Component Replacement

- A RAID controller is replaced when powered down. Other component modules, such as the PSU modules and drive trays, are hot-swappable and can be replaced while the system is operating.
- Qualified engineers who are familiar with the system should be the only ones who make component replacements. If you are not familiar with the system and/or with RAID system maintenance in general, it is strongly advised that you refer system maintenance to a suitably qualified engineer.
- When replacing any hot-swappable component, caution should be taken to ensure that the components are handled in an appropriate manner. Rough or improper handling of components can lead to irreparable damage.
- When removing a RAID controller from a single-controller system, ensure that your applications have been properly closed, users notified of the downtime, all cached writes conducted, etc. Ensure that all precautionary measures, without exception, are adhered to.



WARNING!

When inserting a removable module, **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the connector pins either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more force to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.

5.2. Replacing a Controller Module

5.2.1 Overview

Two replaceable components are contained in a controller module:

- DIMM Module: The DIMM module can be replaced when a DIMM module fails or if a larger capacity DIMM is required.
- CBM (optional): As part of the CBM module, a BBU within is usually replaced every three (3) years. If a BBU has lost its ability to hold electric charge, replace it with a certified module.

**WARNING!**

1. The BBU within the chassis is not hot-swappable. BBU is contained in a RAID controller canister. To replace a BBU, you must remove a RAID controller. It is recommended to remove the BBU before replacing a DIMM module because once a controller is removed from the chassis, BBU will discharge to support the cache memory. If you replace a DIMM module with supplied voltage, damage may occur.
2. Replace a DIMM **one (1) minute** after the BBU is removed.

5.2.2 Notes on Controller Maintenance

- Re-using the DIMM module removed from a failed controller is not recommended unless you have a similar RAID system to test its integrity.
- When replacing the controller module, you must remember that the controller board is one of the most sensitive components in the system. All previously stipulated safety precautions (see **Chapter 2**) must be strictly adhered to. Failure to adhere to these precautions can result in permanent damage and timely delays.

5.2.3 Removing a Controller Module

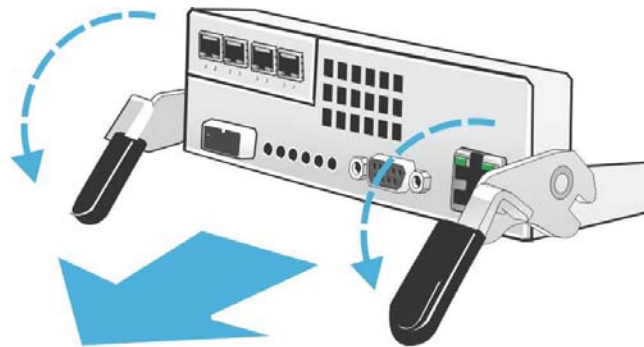
To remove a controller module:

- Step 1.** Prepare a clean, static-free work pad or container to place the controller that will be removed from the chassis.
- Step 2.** **Make sure there is no access from host computers to the system to avoid losing data.** Stop all I/O access to the system and make sure all cached writes have been distributed to disk drives using firmware's "**Shutdown Controller**" function (if access to controller firmware is still possible).

This function is accessed from **Main Menu** -> **System Functions**.



- Step 3. Power off the system.** Power off the system in the way described in **Chapter 3**. Be sure to flush all cached data before powering off the system. If it is not possible to do this **turn off** both PSU modules and disconnect the power cords.
- Step 4. Disconnect all cables** that are connected to the controller module you wish to replace.
- Step 5. Loosen the retention screws from controller.** Use a medium-size Phillips screwdriver to remove the screws underneath each of the ejection levers. Keep the screws for later use.
- Step 6. Remove the controller module** by pressing down the two ejection levers. The controller will be eased out of the module bay. Gently pull the controller module out of the system with one hand underneath to support the weight of the module.



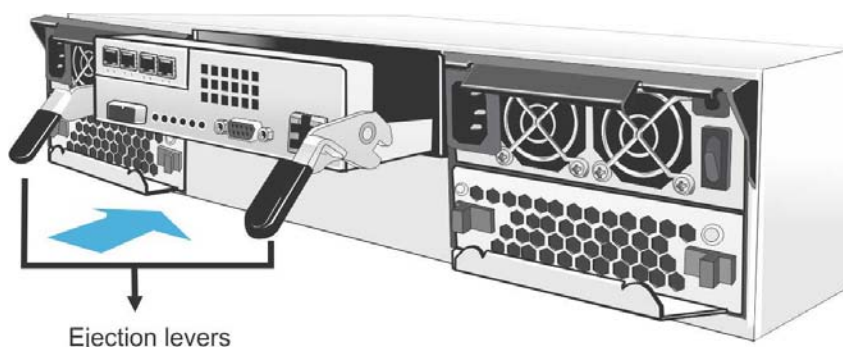
Removing a Controller Module

5.2.4 Replacing the Controller Module

If the controller module has failed, replace a failed controller with a replacement from your vendor:

- Step 1. Remove the failed controller.**
- Step 2. Install a DIMM module on the replacement controller, if it does not come with a DIMM.** See the section *Replacing or Upgrading Memory Modules* in this chapter for more information.
- Step 3. Insert the controller module.** Align the controller module with the controller module bay, making sure that the levers are down. Gently slide the module in.
- Step 4. Secure the connection.** When the controller is reaching the end and you feel the contact resistance, use slightly more force to mate the controller with backplane connectors. When the controller is almost fully inserted, pull the ejection levers up to

secure the controller. The levers help ensure that the back-end connectors are properly mated.



Inserting a Controller Module

- Step 5. Fasten the retention screws.** Once fully inserted, secure the controller module to the chassis by fastening retention screws through the holes on the ejection levers.
- Step 6. Re-attach all the cables** that you previously disconnected.
- Step 7. Power up** the system.

Check for system message on the LCD screen, GUI manager, or firmware menu-driven utility. When the replacement controller is successfully brought online, its **Controller status LED** should light green on its faceplate.

5.3. Replacing or Upgrading Memory Modules

5.3.1 Installation Overview

- The system comes with a pre-installed 1GB (or above) DDRII DIMM module. The controller supports a memory module up to 4GB in size. If you need a larger DDRII module or the original DIMM module malfunctions in some way, the pre-installed module can be replaced. Replacement and installation instructions are described below.
- A DIMM socket is located on the controller main circuit board.



WARNING!

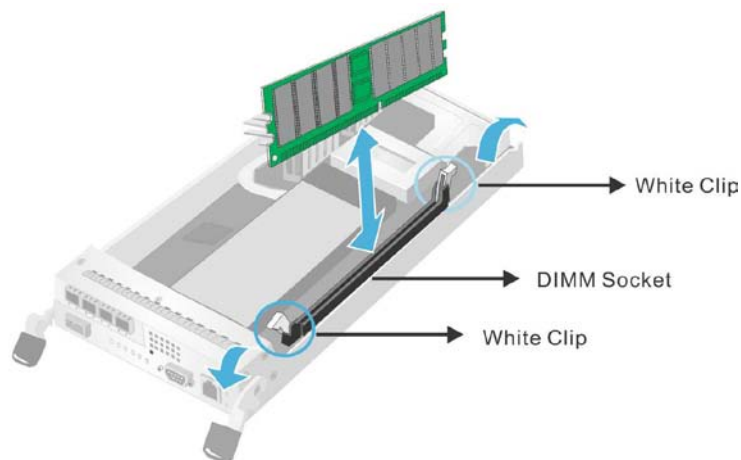
The controller board in the controller module is a sensitive item. Please ensure that all anti-static precautions stipulated above are strictly adhered to.

5.3.2 Selecting the Memory Modules

Compatibility: To avoid compatibility issues, it is recommended to contact your system vendor for a compatible module. We provide tested modules from reliable vendors with reliable chips.

5.3.3 DIMM Module Installation

- Step 1.** Use of an ESD grounding strap is highly recommended.
- Step 2.** **Remove the controller module.** (See previous section for details).
- Step 3.** **Remove the BBU module, if installed.** Carefully place the module, for it contains Li-Ion batteries. Do not drop it onto the floor or place it near any heat source.
- Step 4.** **Wait one (1) minute** for the remaining electricity on the main board to disperse. **Remove the faulty module from the DIMM socket.** To do this, push down the white module clips on either side of the DIMM socket. The DIMM will be ejected from the DIMM socket.



Removing a DIMM Module

- Step 5.** **Insert the replacement module into the DIMM socket.** Make sure the white clips of the DIMM socket are in the open positions. Align the DIMM module with the DIMM socket by checking its "keyed" position. Once aligned, gently and firmly push the DIMM module into the socket. The white clips on the sides of the socket will close automatically and secure the DIMM module into the socket.
- Step 6.** **Reinstall the BBU module.** See the section *Installing CBM (Optional)* in Chapter 2 for detailed descriptions of relevant procedures.

- Step 7.** Reinstall the controller module. After the DIMM module has been properly installed, install the RAID controller.

5.4. Replacing a Faulty CBM

The CBM module can sustain and transfer cached data to a flash backup module in the event of a power outage or in the unlikely event of both PSUs failing.

A BBU consists of a metal bracket, battery cell pack, and a PCB board that connects to the charger board. BBU supplies power during data transition from cache memory to flash. Please read the BBU handling precautions below before handling BBUs.

5.4.1 BBU Fault Conditions:

A BBU failure can result from the following:

1. A BBU has lost its ability to hold electrical charge. This may be the case after the battery cells have been recharged for many times regardless of how long the module has been used. Therefore, a stable power source is important for system operation.
2. The charger circuitry implemented with the controller has failed.

There are other conditions that might trigger BBU fault events and the BBU fault LED:

1. The temperature sensor on the system's charger circuit reports a temperature reading exceeding the pre-set threshold. The charger circuits will enter a low-power and self-protection state.
2. A BBU module has been charged for over twelve (12) hours. A timer is embedded with the charger. When this occurs, the charger will enter a timer fault state. This condition usually occurs with a brand new BBU or with a totally discharged BBU. Charging will resume automatically if you remove/re-install the BBU module or reset the system.

5.4.2 BBU Warnings and Precautions

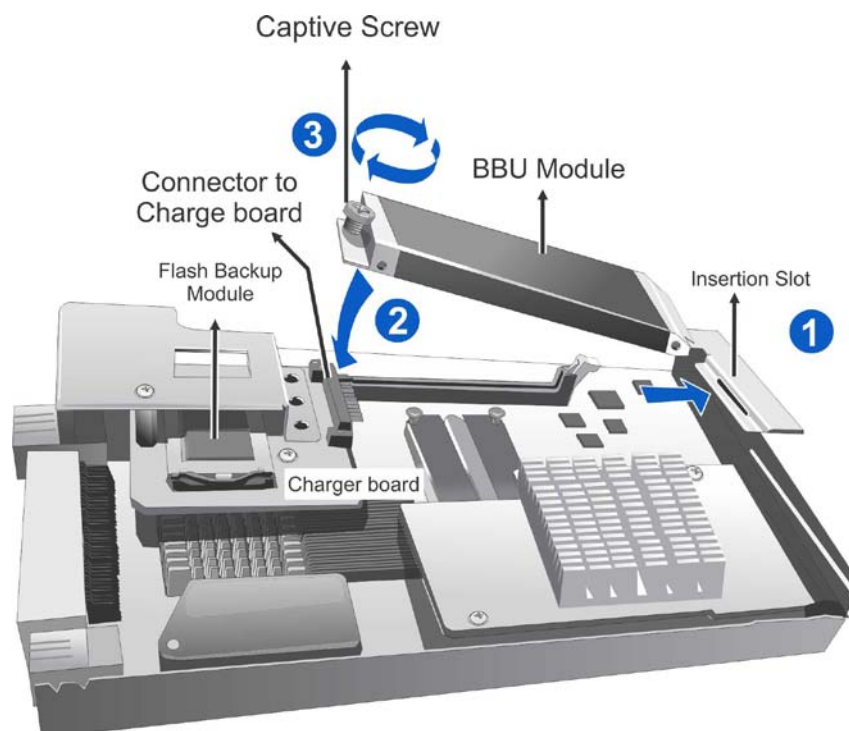
- Install or replace the BBU with BBUs supplied by your Galaxy HDX4 DS vendors only. Use of battery cells provided otherwise will void your warranty.
- Always dispose of a replaced battery in an ecologically responsible manner. Dispose of used BBUs at authorized battery disposal sites only.

- Do not place a BBU near a heat source. Heat can melt the insulation and damage other safety features of battery cells, possibly causing acid leak and result in flames or explosion.
- Do not immerse the BBU in water nor allow it to get wet. Its protective features can be damaged. Abnormal chemical reactions may occur, possibly causing functional defects, acid leak, and other hazardous results.
- Do not disassemble or modify the BBU. If disassembled, the BBU could leak acid, overheat, emit smoke, burst and/or ignite.
- Do not pierce the BBU with a sharp object, strike it with a hammer, step on it, or throw it. These actions could damage or deform it and internal short-circuiting can occur, possibly causing functional defects, acid leak, and other hazardous results.
- If a BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the system and stop using it. If this is discovered when you first use the BBU, return it to your system vendor.

5.4.3 Replacing a Faulty BBU

To replace a BBU, please follow these steps:

- Step 1.** Remove controller as previously described.
- Step 2.** **Remove the faulty BBU from the chassis.** Loosen the captive screw at the end of BBU module.
- Step 3.** Install the replacement module by orienting its protruding edge on one side into the insertion slot, and lowering it towards the charger board. See **#1** in the figure below.



Installing BBU into a Controller

- Step 4.** Carefully align the BBU connector with that on the charger board. Put the BBU down to mate the connectors. Guide pins on the BBU will help ensure proper connection. See #2 in the figure above.
- Step 5.** **Secure the BBU by fastening its captive screw.** See #3 in the figure above.
- Step 6.** **Re-install the controller,** as previously described.
- Step 7.** **Power on the system.** The BBU LED will start flashing to indicate that the BBU is being charged. When the BBU is fully charged, the LED will be off.



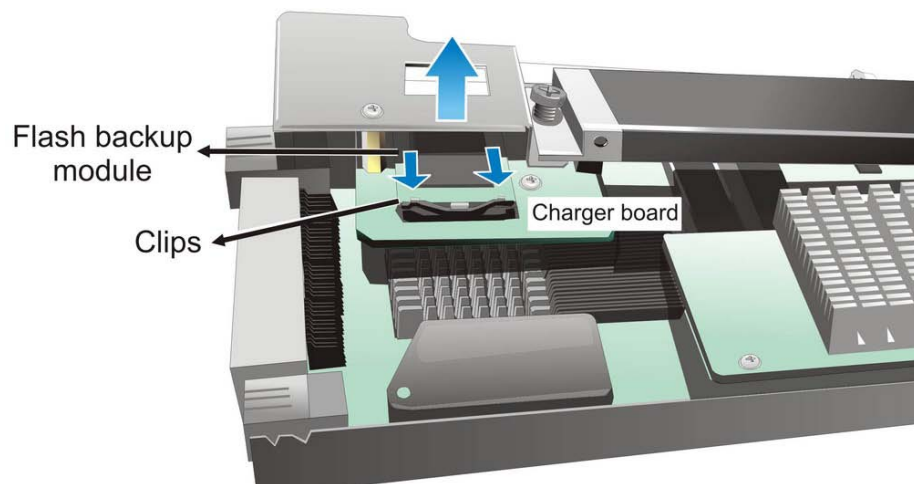
NOTE:

1. A replacement BBU takes approximately twelve (12) hours to charge to its full capacity. Reset the system whenever a BBU is replaced or added in order for the replacement module to take effect.
2. The life expectancy of a BBU is three (3) years. Follow the procedures above to replace a used BBU in order to maintain the fault tolerance feature.
3. The chance of BBU charger failure is comparatively low. If the cause of a failure cannot be determined even after a BBU module is replaced, contact your system vendor for a replacement controller and return the controller through standard RMA procedure.

5.4.4 Replacing a Faulty Flash Backup Module

To replace a flash backup module, please follow these steps:

- Step 1.** Remove controller as previously described.
- Step 2.** **Remove the faulty flash backup module from the charger board** using the index fingers from both hands to pull the retention clips away from the flash backup module. If the flash backup module does not easily disengage, use your finger nails to pick it up. Once released, the flash backup module will pop up. You can then remove it from the socket.
- Step 3.** Insert a replacement flash backup module into the socket at a fifteen (15) degree angle. When fully inserted, press the flash backup module down until it is snapped by the retention clips.



Installing Flash Backup Module into a Controller

5.5. Replacing a Faulty PSU

5.5.1 Notes on PSU Module Maintenance

- **Redundant, load-sharing PSU modules:** The system comes with two fully redundant, hot-swappable PSU modules.
- **PSU canister:** Each PSU module is housed in a robust steel canister, with the power supply converter unit in the front and two juxtaposed cooling fans in the rear section. When the PSU is removed from the chassis, the cooling module is also removed.
- **Immediate replacement:** When a PSU fails, it should ideally be replaced immediately. Do not remove the PSU module unless a replacement is readily available. Removing a PSU without a replacement

will cause severe disruptions to the internal airflow and the system will overheat, possibly causing irreparable damage to some of the system components.



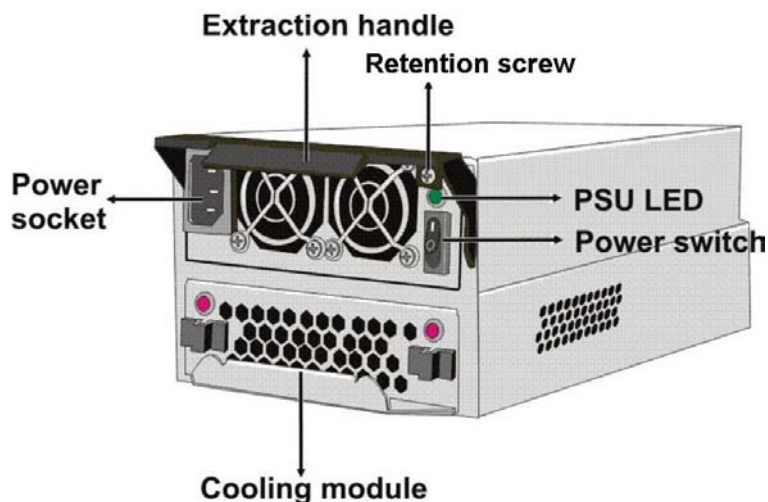
WARNING!

Although the system can operate using a single PSU module, it is not advisable to run the system with a single PSU module for an extended period of time.

5.5.2 Replacing the PSU Module

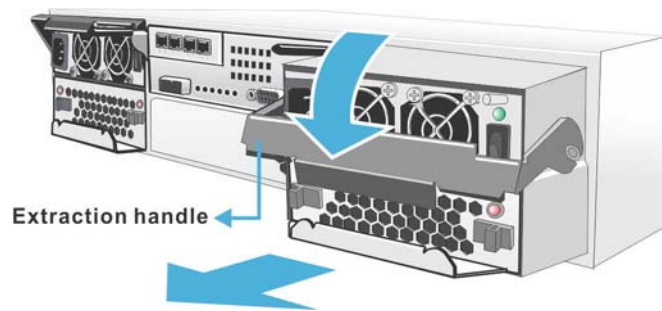
To replace a PSU, please follow these steps:

- Step 1. Power off the PSU.** The power switch is located on each PSU's rear-facing panel.
- Step 2. Disconnect the power cord** that connects the PSU to the power source.
- Step 3. Loosen the retention screw** that secures the extraction handle to the chassis using a Phillips screwdriver. See below drawing for its location.



PSU Parts Identification

- Step 4. Remove the PSU module** by pulling the extraction handle down. The extraction handle should gracefully disconnect the PSU from the backplane connectors. Once dislodged, gently pull the PSU module out of the system. If the system is mounted in a rackmount rack, use another hand to support its weight while removing the module.



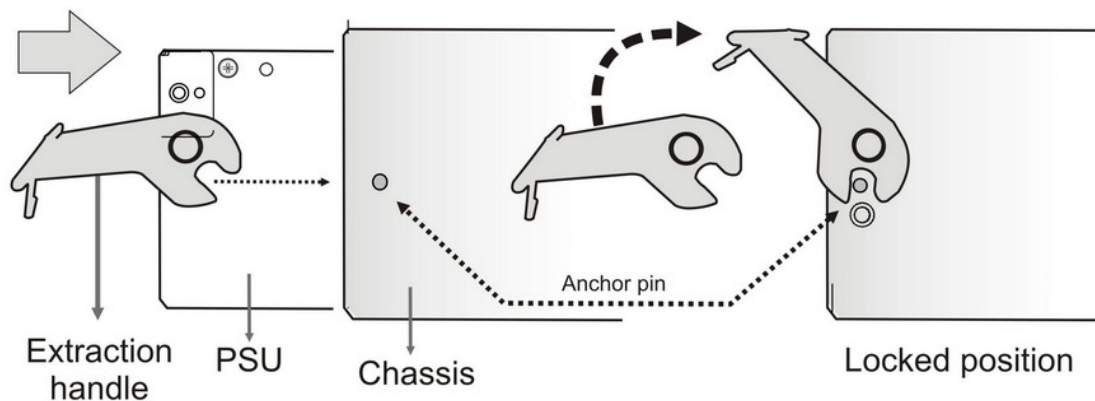
Removing the PSU Module



WARNING!

When a P SU is r emoved form t he c hassis, t he c ooling m odule i s also removed from the chassis. Hence the airflow provided by the cooling module i s also disabled. With an em pty m odule bay, airflow will also be disrupted. It i s t herefore r ecommended t he r eplacement pr ocedure i s completed i n l ess t han f ive (5) m inutes t o prevent t he s ystem f rom overheating.

- Step 5. Install the replacement module.** Make sure the extraction handle is held at its lowest position so that the saddle notches on the sides of the handle can snap onto the metal anchor pins on the interior walls of the PSU slot. Push the PSU into chassis, and when you feel the contact resistance, pull the handle upwards to secure the module.



Securing PSU Using the Extraction Handle

- Step 6. Secure the P SU t o t he system** by fastening the retention screw through the PSU extraction handle.
- Step 7. Replace the power cord** that connects the PSU module to the mains.
- Step 8. Power on the PSU module.**

5.6. Replacing a Faulty Cooling Module

5.6.1 Notes on Cooling Module Maintenance

- **Redundant cooling modules:** The system is equipped with four (4) cooling blowers, two (2) within each cooling module. These cooling modules control the internal operating temperature and therefore their working integrity should be maintained at all times.
- **Detecting a failed cooling module:** If a cooling module fails, system firmware and Web GUI manager will deliver warning events. The LEDs located on the rear of the enclosure will light red and an audible alarm will be triggered.
- **Airflow Concern:** Once you are notified that a cooling module has failed, it should be replaced as soon as possible. A failed module should only be removed from the system when you have a replacement module immediately available.

5.6.2 Replacing a Cooling Module

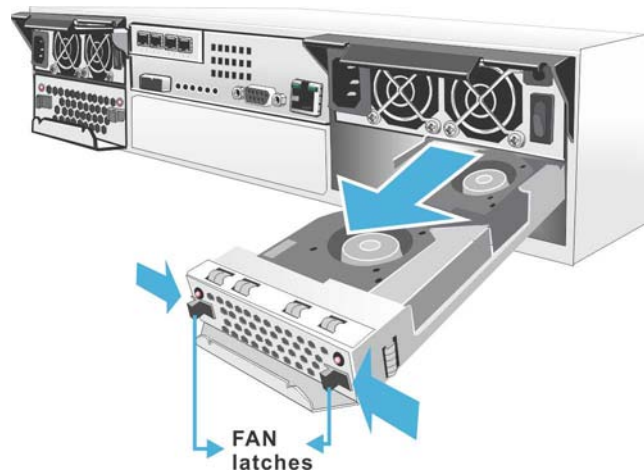
If one of the cooling modules fails, it must be replaced as soon as possible. To replace the cooling modules, follow the steps below:



WARNING!

The fan replacement process should be completed within five (5) minutes. If the process takes too long, the accumulated heat can damage the system.

- Step 1.** Snatch the retention latches towards the center, and then pull the cooling module out of the chassis.



Removing a Cooling Module

- Step 2.** Install the replacement module by pushing it into the module bay. When fully inserted, the retention latches will hold the module in place.
- Step 3.** A firmware event will prompt shortly afterwards stating that the cooling module is back online. The LEDs on the replacement module should not be lit when installed.

5.7. Replacing a Hard Drive

5.7.1 Hard Drive Maintenance Overview

- **Hot-swappable drive trays:** The drive trays are all hot-swappable. A disk drive failure can be corrected online.
- **Handles:** If a faulty drive is behind either the left- or right-side front handle, unfold the handles to open the front access to the drive trays.



CAUTION!

Failure to remove a healthy drive from the system after the front bezel has been opened can cause data errors.

- **Slow and careful removal:** When removing a drive tray from the system, **pull the drive tray out only about one inch and then wait for at least 30 seconds for the hard drive motor to spin down before taking it out completely.** Any impact to the hard drive while the drive motor is spinning can damage the hard drive.

There are situations in which healthy drives can be removed. In operations such as copying & replacing member drives with drives of larger capacity, you may need the replaced disk drives in other installations.

5.7.2 Replacing a Hard Drive

To replace a hard drive, please follow these steps:



WARNING!

Hard drives are fragile; therefore, always handle them with extreme care.

- Do not drop the hard drive.
- Always be slow, gentle, and careful when handling a hard drive.
- Handle a hard drive only by the edges of its metal cover, and avoid touching its circuits part and interface connectors.

Step 1. Identify the location of the drive tray that contains a hard drive indicated as faulty. You may use firmware utility or Web GUI software to locate a faulty drive. The drive tray LED should also light red. The diagram below shows the numbering of the hard disk drive slots.

Slot 1	Slot 2	Slot 3	Slot 4
Slot 5	Slot 6	Slot 7	Slot 8
Slot 9	Slot 10	Slot 11	Slot 12

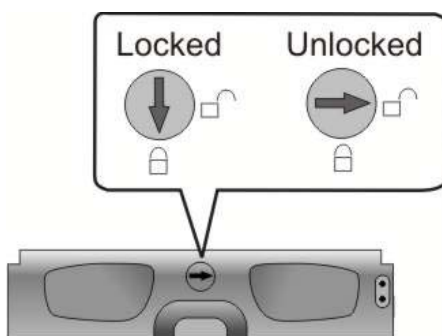
Hard Drive Numbering



WARNING!

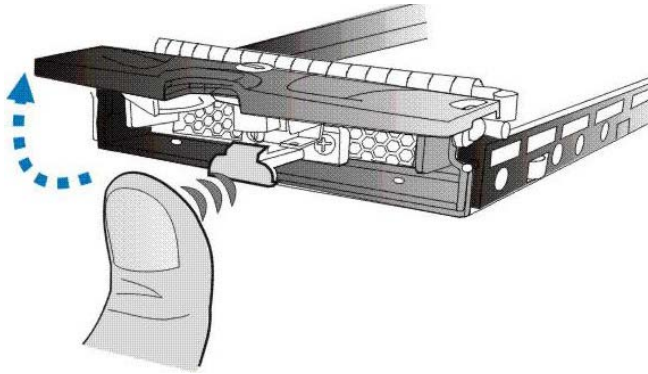
Removing the wrong drive can fatally destroy a logical drive.

Step 2. Use a flatblade screwdriver to turn **the rotary bezel lock to the unlocked position**, i.e., the groove on its face is in a horizontal orientation.



Opening the Front Flap

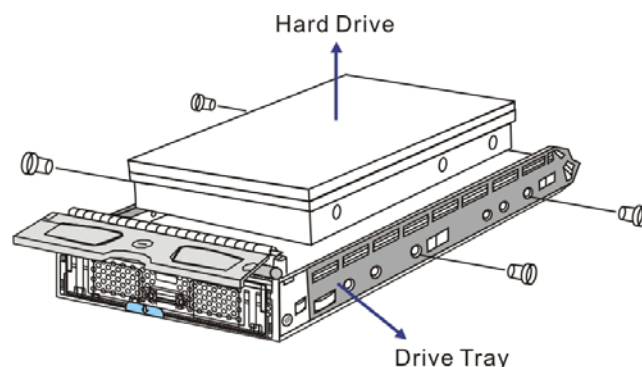
Step 3. Open the tray bezel by pushing the release button. The front bezel will automatically swing open.



Opening the Drive Tray Front Bezel

Step 4. Remove the drive tray by pulling it one inch away from the drive bay. Wait for at least 30 seconds for the disk drive to spin d own, and then gently and carefully withdraw the drive tray from the chassis.

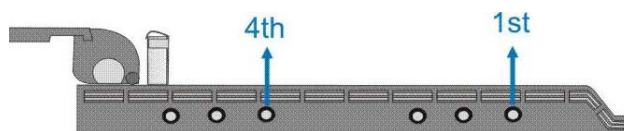
Step 5. Remove the four (4) retention screws that secure the hard drive from the sides of the drive tray (two on each side).



Loosening the Hard Drive Screws

Step 6. Place the replacement drive into the drive tray, making sure that the interface connector is facing the open side of the drive tray, and the label side facing up.

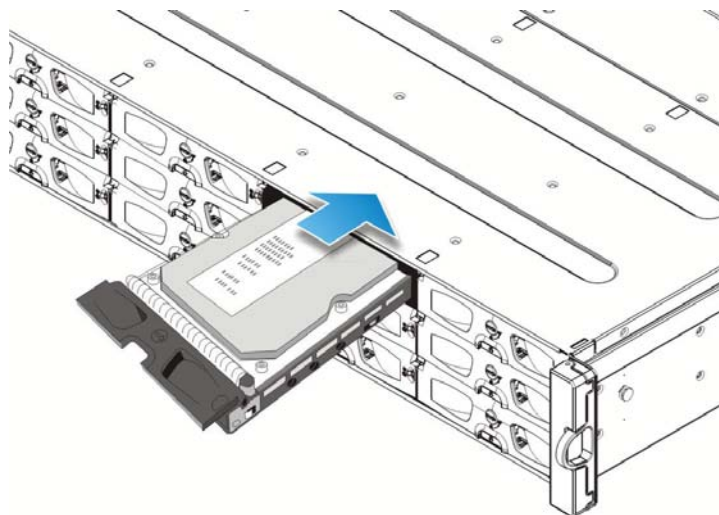
Step 7. Adjust the drive's location until the mounting holes in the drive canister are aligned with those on the hard drive.



Drive Mounting Hole Locations

Step 8. Secure the disk drive with four (4) of the supplied 6/32 flat-head screws.

Step 9. Align the drive tray with a drive bay. Gently slide it in until the drive tray reach the end of drive bay. This should be done smoothly and gently.



Installing a Drive Tray

- Step 10.** **Close the front bezel.** Make sure the front bezel is closed properly to ensure that the back-end connector is properly mated with the corresponding connector on the backplane. If the front bezel cannot be closed properly, the connection between the hard drive and the system may come loose and mysterious drive signals may result.
- Step 11.** **Lock the bezel into place** by turning the bezel lock until the groove on its face is pointing down (vertical orientation).
- Step 12.** The **Drive Busy LED** will light up after a few seconds meaning the system is attempting access.

If the replaced drive belonged to a logical drive with fault tolerance, e.g., RAID levels 1, 3, 5, or 6, a logical drive rebuild process will automatically begin. You should then verify the beginning of the rebuild process using Web GUI or a terminal console. A firmware message, “Rebuilding LD __,” should also pop up on the LCD screen.

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Appendix A

Specifications

A.1. Technical Specifications

Environmental Specifications	
Humidity	5 to 95% (non condensing – operating and non-operating)
Temperature	Operating: 0° to 35°C (40°C if BBU is removed) Non-operating: -40° to 60°C
Altitude	Operating: Sea level to 3660m (12,000 ft.) Non-operating: Sea level to 12,192m (40,000 ft.)

Power Requirements	
Input Voltage	100VAC @ 10A to 240VAC @ 5A with PFC (auto-switching)
Frequency	47 to 63Hz
Power Consumption	530W

Dimensions	With Forearm Handles (and PSU protrusions)	Without Forearm Handles
Height	89mm	88mm
Width	481mm	446mm
Depth	531mm	514mm

Certifications	
Safety UL (60950-1 2'nd) BSMI CNS 14336: 2005 CB IEC 60950-1, 2'nd Edition GOST-R GOST R 60950-1-2005	
EMC CE EN 55022: 2006/A1:2007 EN 61000-3-2: 2006 EN 61000-3-3: 1995/A1: 2001 /A2: 2005 EN 55024: 1998/A1: 2001/A2: 2003 BSMI (CNS 13438) FCC (FCC Part 15,subpart B)	
Certificates IEC 60068-2, MIL-STD-810E/883E, ISTA, ASTM-D3332, IPC-TM-650 IEC 61000-4-2:1995/A2:2000 IEC 61000-4-3:1995/A2:2006 IEC 61000-4-4:2004 IEC 61000-4-5:2005 IEC 61000-4-6:2003/A1:2004/A2:2006 IEC 61000-4-8:1993/A1:2000, IEC 61000-4-11: 2004 IEC 61000-3-2, IEC61000-3-3 ISO7779/3744 RoHS Microsoft WHQL-Windows Server 2003	

Shock	
Half-sine	Operating: 5G peak, 11ms duration
	Non-operating: 15G, 11ms duration

Vibration	
Operating	0.5oct/min, 5 to 500Hz, sinewave, 0.2G
Non-operating	0.5oct/min, 5 to 500Hz, sinewave, 1.0G

Warning Alarms

- Audible alarms
- System LEDs
- Web GUI management suite
- LCD screen
- RS-232C terminal
- Event notifications sent over email, fax, LAN broadcast, SNMP traps, MSN messenger, SMS short messages

A.2. Controller Specifications

A.2.1 Configuration

Specification	
RAID Levels	0, 1(0 + 1), 3, 5, 6, 10, 30, 50, 60, and non-RAID disk spanning
Host O/S Compatibility	Host O/S independent; also dependent on iSCSI offload utilities and hardware
Host Interface	RJ-45 Gigabit Ethernet
Host Channels	4 pre-configured host channels per controller
Drive Interface	Supports up to 12 channels of 6Gb/s SAS or 3Gb/s SATA
Drive Channels	All drive channels are pre-configured and cannot be changed
Cache Mode	Write-through, write-back, and adaptive write policy
Cache Memory	Pre-installed 1GB (or above) DDRII module with ECC, registered; in one DIMM socket
Number of LUNs	Up to 32 per host ID; depends on DIMM size
Multiple Target IDs/Host Channel	Yes
Firmware on Flash Memory	Yes
Drive Hot-swap	Yes; with transparent reset of non-responsive drives
Controller Hot-swap capability	Yes

A.2.2 Architecture

Specification	
CPU	PowerPC 800GL
Gigabit Ethernet Chip Controllers	Intel 82580 x 1 (4 channels per controller)
DIMM Slot	For one 240-pin DDRII SDRAM module
ASIC	ASIC667 64-bit chipset
Flash ROM	64Mbit (8MB)
Hardware XOR	Yes
Real-time Clock	For event messages with time record and task scheduling

A.3. Power Supply Specifications

Specification	
Nominal Power	530W with active PFC
DC Output	12.0V: 25A (Max.) 5.0V: 43A (Max.)
Efficiency	80 PLUS-certified delivering more than 80% energy efficiency
Input Frequency	47 to 63Hz
AC Input	100VAC @ 10A to 240VAC @ 5A with PFC
Power Factor Correction	Yes
Hold-up Time	At least 20ms at 115/230VAC full load after a loss of AC input
Over-temperature Protection	Auto shutdown when lost cooling or exceeded ambient temperature; over-voltage protection is also available.
Cooling Fans	No fans specific for PSU; heated air is drawn by the cooling fan module fixed in the rear section of PSU.

A.4. RAID Management

Specification	
Configuration	<ul style="list-style-type: none">• Text-based firmware-embedded utility over RS-232C through a DB-9 male to DB-9 female serial cable• LCD keypad panel• The Web GUI Manager program using the Ethernet management port (10/100BaseT) or in-band connection over host links.• Menu-driven, text-based firmware-embedded utility via telnet• http session with Embedded Web GUI that resides in controller flash
Performance Monitoring	Yes
Remote Control and Monitoring	Yes using ethernet 192.168.1.129
Event Broadcast/Alert	Yes (via Web GUI sub-modules, the Notification Manager utility, or the firmware-embedded browser-based Web GUI)
Hardware Connection	over Ethernet or RS-232C
Configuration on Disk	Configuration data stored on disks for logical drive assemblies to exist after controller replacement; basic settings, e.g., channel mode settings, are stored on NVRAM. Applies to uses such as Drive Roaming.
Failure Indicator	Via audible alarm, system LEDs, LCD keypad panel, Web GUI Manager session, event messages, or terminal emulation screen

A.5. Fault Tolerance Management

Specification	
Drive S.M.A.R.T. support	Yes, with user-configurable detect-only, clone-and-replace, and perpetual-clone options. The S.M.A.R.T. feature depends on HDD implementation.
CBM (Cache Backup Module)	Yes
Sensors and Module Presence detection through an I ² C serial bus.	Yes, reported to firmware. Events occurred in JBODs are reported through SES commands via the SAS data links back to the managing RAID enclosure.
Automatic Drive Failure Detection	Yes
Automatic Rebuild on Spare Drives	Yes
Regenerate Logical Drive Parity	Yes
Bad Block Reassignment	Yes
Automatic Rebuild upon Failed Drive Replacement	Yes

Manual Clone of Suspected Failed Drive	Yes
Concurrent Rebuild on Multiple Drives in a RAID (0 + 1) or RAID6 Logical Drive	Yes
Event-triggered operation	Firmware applies conservative write-through operation in the event of module failures, and raises fan rotation speed.

Appendix B

Pinouts

B.1 GbE Ethernet Port Pinouts (iSCSI Host Ports)

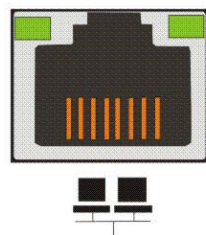
Automatic MDI/MDI-X Crossover: Crossover can be implemented internally at hub or switch or externally through twisted pair media.

Pin	Pin Name	Color Match
1	BI_DA+	Orange
2	BI_DA-	Orange/white
3	BI_DB+	Green
4	BI_DC+	Blue/white
5	BI_DC-	Blue
6	BI_DB-	Green/white
7	BI_DD+	Brown
8	BI_DD-	Brown/white

GbE Ethernet Port Pinouts

B.2 Ethernet Management Port Pinouts

Link Activity

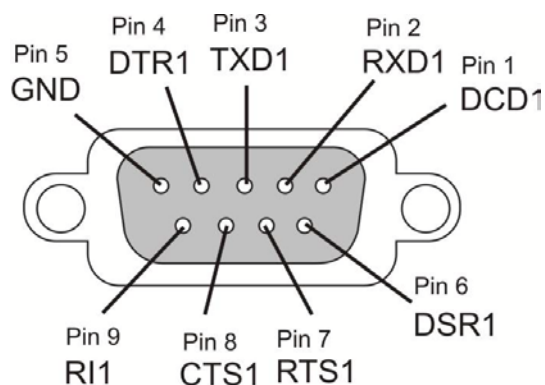


Ethernet Port Pinouts

Pin	Pin Name	Pin	Pin Name
1	LAN_TXP	5	N2
2	LAN_TXN	6	LAN_RXN
3	LAN_RXP	7	N1
4	N2	8	N1

Ethernet Port Pinout Definitions

B.3 DB-9 Serial Port



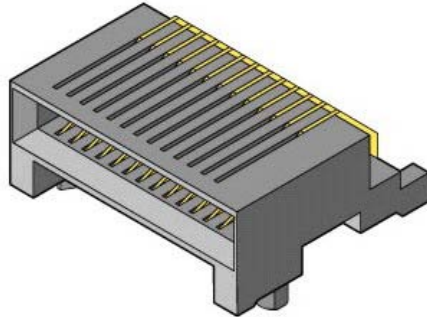
Serial Port

Pin	Pin Name	Description
1	DCD1	Data Carrier Detect
2	RXD1	Receive Data
3	TXD1	Transmit Data
4	DTR1	Data Terminal Ready
5	GND	Ground
6	DSR1	Data Set Ready
7	RTS1	Request to Send
8	CTS1	Clear to Send
9	RI1	Ringing indicator

Serial Port Pinout Definitions

B.4 SAS Expansion Port Pinouts

The Mini SAS host ports comply with SFF-8088 specification.



Mini SAS SFF-8088 Connector

Pin	Description	Pin	Description
A1	GND	B1	GND
A2	RX0+	B2	TX0+
A3	RX0-	B3	TX0-
A4	GND	B4	GND
A5	RX1+	B5	TX1+
A6	RX1-	B6	TX1-
A7	GND	B7	GND
A8	RX2+	B8	TX2+
A9	RX2-	B9	TX2-
A10	GND	B10	GND
A11	RX3+	B11	TX3+
A12	RX3-	B12	TX3-
A13	GND	B13	GND

SAS Expansion Port Pinout Definitions

B.5 Power

IEC-type receptacle.



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